DOCTOR OF PHILOSOPHY

An Exploration of the Characteristics of the Indicators of a Sustainability Assessment Framework for Neighbourhood Developments in Metropolitan Lagos Nigeria

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AN EXPLORATION OF THE CHARACTERISTICS OF THE INDICATORS OF A SUSTAINABILITY ASSESSMENT FRAMEWORK FOR NEIGHBOURHOOD DEVELOPMENTS IN METROPOLITAN LAGOS NIGERIA

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ABBREVIATIONS AND ACRONYMS

AHP- Analytical Hierarchy Process
ANP- Analytic Network Process
ANOVA- Analysis of Variance
AUPC- Abu Dhabi Urban Planning Council
BEA- Building Environmental Assessment
BEQUEST- Built Environment Quality Evaluation for Sustainability
BPMSG- Business Performance Management Singapore
BREEAM- Building Research Establishment Environmental Assessment Method
CASBEE- Comparative Assessment System for Built Environment Efficiency
CDI- City Development Index
CNU- Charter of the New Urbanism
CR- Consistency Ratio
CV- Coefficient of Variation
CVR- Content Validity Ratio
DPSIR- Driving Pressure State Impact Response
EEA- European Environment Agency
EIA- Environmental Impact Assessment
EPA- Environmental Protection Agency
FESTAC- Festival of Arts and Culture
FHA- Federal Housing Authority
FMLHUD- Federal Ministry of Land Housing and Urban Development
GBCA- Green Building Council of Australia
GBCSA- Green Building Council of South Africa
GHGBC- Ghana Green Building Council
GCI- Global Cities Indicators
HCI- Healthy Cities Indicators
LABCA- Lagos Building Control Agency
LASG- Lagos State Government
LASPPDA- Lagos State Physical Planning and Development Authority
LAWMA- Lagos State Waste Management Authority
LBIC- Lagos Building Investment Company

LCA- Life Cycle Assessment
LEED-ND- Leadership in Energy and Environmental Design for Neighbourhood Development
LSDPC- Lagos State Property Development Commission
MCDA- Multi-Criteria Decision Analysis
MPPUD- Ministry of Physical Planning and Urban Development
MCP- Model City Plans
MoH- Ministry of Housing
NHP- National Housing Policy
NSAF- Neighbourhood Sustainability Assessment Framework
NTDA- New Town Development Authority
NRDC- Natural Resources Defence Council
OECD- Organisation for Economic Co-operation and Development
ODPM- Office of the Deputy Prime Minister
PCRS- Pearl Community Rating System
PROMETHEE- Preference Ranking Organisation Method for Enrichment of Evaluations
PSR- Pressure State Response
REDAN- Real Estate Development Association of Nigeria
SSA- Sub Sahara Africa
SDGs- Sustainable Development Goals
STAMP- Sustainability Assessment and Measurement Principles
TBL- Triple Bottom Line
UAE- United Arab Emirates
UNCED- United Nations Conference on Environment and Development
UK- United Kingdom
UN- United Nations
UNDESA- United Nation Department for Economic and Social Affairs
UN-HABITAT- United Nations Human Settlements
US- United States of America
USGBC- United States Green Building Council
WCED- World Commission on Environment and Development

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DEDICATION

This research work is dedicated to the Almighty God, the true source of wisdom.

DECLARATION

I, Ayomikun Solomon Adewumi hereby declare that this thesis is purely an academic work conducted by me. Studies not conducted by me have been adequately cited in accordance with the relevant Ordinance and Regulations of the University of Dundee. This thesis has not been presented either wholly or partially for any degree in the United Kingdom or Overseas.

All the views presented in this thesis are primarily those of the author and do not in any way represent the views of the University of Dundee.

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ABSTRACT

Rapid urban population growth possesses an ongoing and future sustainability challenge, as it is predicted that 68 per cent of the world's population will be living in cities by the year 2050. This means that the battle for sustainability will be won or lost in cities, further raising significant concerns on how to make urban areas sustainable. Some key efforts in addressing this challenge can be seen on two fronts. One is the recognition of the neighbourhoods, and the neighbourhood scale as a necessary building block of cities. Two is the acknowledgement that neighbourhoods can be viewed as products of a rational planning and decision-making process. These two understandings have converged and heralded Neighbourhood Sustainability Assessment Frameworks (NSAFs) which permit sustainability aspects to be integrated at the decision-making windows of a new development.

To date, whilst NSAFs have been developed and applied in western countries, areas such as Sub Saharan Africa (SSA) where urbanisation is rapidly expanding, have in contrast seen little empirical work towards their context-specific NSAFs. Yet the extent to which existing NSAFs designed for the western world, can be transferred to another context remains a significant question because the NSAFs are designed to suit a particular set of values, aspirations and needs. This is both a problem and a challenge, in terms of how urban areas in SSA contexts, can be systematically steered towards sustainability. This study has therefore been formulated to explore the characteristics of the indicator set of a NSAF that can be used in the decision-making process and development of neighbourhoods in metropolitan Lagos.

To acknowledge that the concept of sustainability in SSA may be subject to its own unique issues has led to the use of critical realism as a philosophical stance which allows the practical realities of the context to inform and shape the interpretations of findings. This is appropriate in this study to interpret data that is generated within a context, and its correct interpretation would only make sense when analysed and understood with a keen eye to the understandings and priorities within that local context. This suggested the embedded and convergent mix-method approach, involving both textual and numeric data, leading to inductive and deductive analysis respectively.

Findings from the study not only helped establish a set of probable indicators that may be applicable; but also unearthed a complexity in stakeholders' understanding of what a sustainable neighbourhood means within the metropolitan Lagos as several definitions emerged. The stakeholders' understanding suggests that such aspects like liveability is crucial in defining sustainability at the neighbourhood level. This tension between stakeholders' reference to elements of sustainability and/or liveability, when trying to define sustainability at the neighbourhood scale, raises a challenge in the validity of NSAFs ability to capture and represent sustainability at that scale of application.

This study concludes that the indicators set of a NSAF cannot be transferred directly for use in another context without some empirical basis prior to its integration into the decision-making process of a new neighbourhood development. It calls for caution as to the extent to which the indicators can be balanced between what is essentially a reference to liveability, rather than sustainability from the perspective of resources flow. In terms of theory, the findings and insight further open the debate of the applicability of the indicator set, especially in other SSA cities, questioning to what extent true sustainability can be promoted through NSAFs. The empirically established set of sustainability indicators in metropolitan Lagos, provide a benchmark for more intense debate. In practice, stakeholders can now be better informed in selecting and prioritising indicators in the decision-making process of a new neighbourhood, as well as guard against the weaknesses of this approach.

CHAPTER 1 INTRODUCTION

This chapter sets the background and context for this study, including capturing the research problem and the assumptions guiding the study. Following the research gap which was identified by synthesising previous and current knowledge about the topic, the chapter presents the rationale of the study, and what makes the study original by highlighting the key contributions to knowledge. It presents key challenges of the growing global urban population stressing the urgency to ensure that the associated scenarios of this growth trend do not lead to development that cannot be sustainable. Emphasising the significance of urban neighbourhoods as building blocks of cities, the chapter introduces and highlights the importance of the decision-making process as a mechanism to integrate sustainability aspects and concerns at the planning stages of a new neighbourhood. It briefly introduces the challenges of urbanisation in Nigeria and how neighbourhoods can play a key role in its sustainability agenda. The chapter concludes with an overview of the methodology through which the research question will be addressed.

1.1 Background and Context

1.1.1 Global Urban Population Growth

In the last 100 years, urbanisation has been more resource-demanding, which contributes significantly to climate change, loss of soil carbon, deforestation, loss of biodiversity, and adverse effects on the living standards of people (Huovila et al., 2019; UN-Habitat, 2016; European Environment Agency, 2015; Lehmann, 2015; Komolafe et al., 2014; Huge et al., 2011). For example, it has been noted that whilst cities occupy just 3 per cent of the earth’s landmass, they disproportionately account for 60-80 per cent of energy consumption and 75 per cent of carbon emissions (UN, 2016; Robinson and Cole, 2015). As more people will be living in urban areas (UN-Habitat, 2015) with more pressure on the built environment, it has been argued that humanity will fail or succeed in the urban areas, making urban areas a crucial arena for assuring our future sustainability (Girardet, 2015; Komeily and Srinivasan, 2016; Martinez-Bravo et al., 2019).

Urban population has increased in recent years, from only 2 per cent of the world's population in 1800 to more than 50 per cent in 2008 (Marans, 2015; Wu et al., 2014), and to 55 per cent in 2018 (figure 1.1). According to UNDESA (2018), it is projected to reach 68 per cent by 2050.

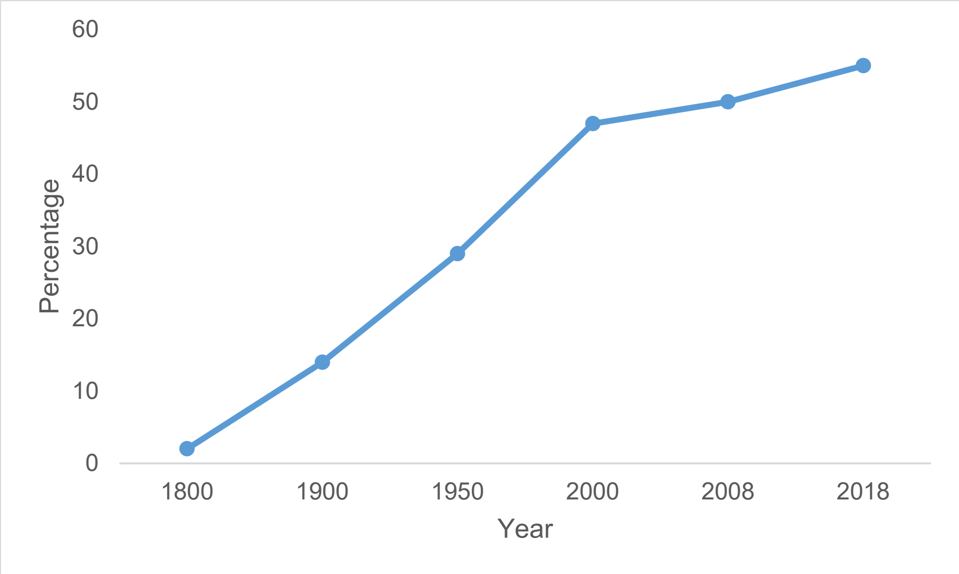

Figure 1. 1: The Rapidly increasing proportion of the world population in cities
Source: after UNDESA (2018) dataset

1.1.2 Implications for Sustainability

Urban population growth has raised significant concerns with urbanisation universally being acknowledged to result in critical challenges for both humans and the environment (Girardet, 2015; Ruth and Franklin, 2014; Kotter and Friesecke, 2011). For example, how can the planning of urban areas be approached in a way that does not multiply the problems associated with rapid urbanism, but instead ameliorate and mitigate them? This has necessitated Bullock et al. (2017), Gehl (2013), and United Nations Human Settlements UN-Habitat (2016) to explore how urban areas can be a part of the overall solution; and instead of being a major cause of unsustainability, serve as a crucial platform for delivering transformative measures towards sustainability.

This raises a fundamental question about the theories, concepts and approaches that can help achieve this aim. Due to this concern, urban planners, environmentalists, architects, and social scientists are exploring environmental, socially and economically friendly urban solutions (Gehl and Svarre, 2013; Madu et al., 2017; and Orazalin and Mahmood, 2018).

Furthermore, the urgency of sustainability in the urban areas has been underpinned in the international discourse and political agreements by force-acting and motivating decisions. For example, in 2016, the New Urban Agenda was adopted at the United Nations Conference on Housing and Sustainable Urban Development (Habitat III) in Quito, Ecuador, as a policy framework that lays how urban areas should be planned and managed to enhance sustainable urbanisation (UN-Habitat, 2016). This is a sequel to the Habitat Agenda (Istanbul Declaration on Human settlements) in 1996, and the Vancouver declaration in 1976, both emphasising the need for sustainable urban places. Additionally, is the 2015 Sustainable Development Goals 11 (SDG 11) which advocated for sustainable communities highlighting the global standards that could be helpful in shaping and delivering such communities by 2030 (UN, 2015).

The SDG 11, for instance, has 10 indicators which can be helpful to operationalise it in a proposed development. Some of these indicators include adequate, safe, and affordable housing; accessible and sustainable transport system; provide universal access to safe public spaces; and inclusive and sustainable urbanisation amongst others. In addition to the SDG 11 are other goals which can be useful in planning for urban sustainability. For example, SDG 3 focuses on delivering good health and well-being, SDG 6 on clean water and sanitation, SDG 7 on affordable and clean energy. Recently, the New Urban Sustainability Frameworks which is an effort to support cities to achieve sustainable futures was adopted by the World Bank (WBG, 2018).

In all these, there has been an increasing debate on the difference ‘sustainability’ and ‘sustainable development’ as further explored in section 2.1.2. This understanding is crucial in order to be able to measure progress. This difference is in which one is a process or a goal (Bond & Morrison-Saunders, 2013). While some scholars like Shen et al. (2011) perceived ‘sustainability’ as a goal and ‘sustainable development’ as a process, Edwards (2012) is of a contrary opinion perceiving 'sustainability' as process as 'sustainablde development' as a goal. In this study, both terminologies are used interchangeably following the direction of Pope et al. (2004).

1.1.3 Planning and Decision-making for Sustainable Urban Areas

The slow progress recorded in the campaign for urban sustainability despite the efforts of both built environment professionals and policymakers has necessitated the need for a re-examination of the processes and methods currently being adopted to accommodate urban growth (Huang et al., 2016; Bibri and Krogstie, 2017; Elmqvist et al., 2018). This need originates with the idea that urban places are a product of a decision-making process, and that, whether an urban area will be sustainable or not depends on the integration and consideration of sustainability aspects in the decision-making process. As a result, city research in recent times has significantly reflected the attention to governance and decision-making (Salama, 2019a).

This understanding of the role of the decision-making process to deliver sustainable urban places underscores the idea that has increasingly been tried, using the neighbourhood as a component building block (Wangel et al., 2016; Berardi, 2013). A sustainable neighbourhood is such which demonstrates the principles of sustainability. That is, it is socially balanced, economically viable, environment-friendly. It is characterised with good connectivity of spaces, high housing density, diversity, engagement with local stakeholders, adaptability, and biodiversity conservation. Using a multi-scale approach, it comprises of buildings that are sustainable in themselves and designed on a layout that enhances diverse mobility options and inclusive in its design. The main argument is that if sustainability considerations, principles, and targets are integrated at the decision-making process of a new neighbourhood, then this can in the long-term and wider picture create a sustainable urban area (Cole, 1999; Komeily and Srinivasan, 2015; Bahadure and Kotharkar, 2018).

This concept and approach of planning at the neighbourhood level are traceable to the 1898 Garden city of Ebenezer Howard and other pioneers like Clarence Perry, among others (see Farr, 2008).

Moreover, the idea of planning to deliver sustainable neighbourhoods is itself an artefact of dedicated decision-making processes that are founded on systematic approaches, with well-articulated inputs and outputs (Caratti, 2004; Bosch et al., 2017). This puts decision-making which is concerned with the evaluation of alternatives and selection of preferred actions (Brandon and Lombardi, 2011) at the heart of planning, designing, and agreeing to permit neighbourhoods that are sustainable.

The need for decision-making stems from the understanding that the various phases of a new development (say a neighbourhood), which are its decision-making windows, have the potential of affecting the existing physical, social, cultural, and economic structure. The decision-making windows according to Jiliberto (2004:45), are "*moments in the decision-making process where critical choices are made, which have an environmental implication*". They serve as an avenue and a suitable entry point to integrate sustainability aspects in decision-making and therefore ensuring sustainable outcomes.

To this end, the need to enhance this integration for more sustainable design solutions in the decision-making process led to the development of Neighbourhood Sustainability Assessment Frameworks (NSAFs) in the closing decades of the twentieth century. Through the framework, a proposed neighbourhood can be assessed against an array of sustainability indicator set, concerns, and targets (Wangel et al., 2016; Bahadure and Kotharkar, 2018) and therefore enhancing decisions about the sustainable designs and options that can be applied in that context (Turcu, 2012). This is an ex-ante approach which allows deciding if the development will potentially contribute to sustainability or not. For example, the carefully selected indicators in the sustainability assessment methodology allow for the integration of sustainability principles, targets, and concerns at the early stage in the decision-making process (Jiliberto, 2004), while also providing guidance on how to prioritise each sustainability indicator for a sustainable neighbourhood to be delivered.

Whilst the use and further development of NSAFs at the various decision-making windows continue in the developed nations (Joss et al., 2015; Sharifi and Murayama, 2015; Yang et al., 2016; Ameen and Mourshed, 2019), most Sub-Sahara African (SSA) countries are yet to evolve such NSAFs for decision-making in order to steer towards sustainable urban places.

1.1.4 Urbanisation in Nigeria

The SSA context which is of interest in this study has grown rapidly in urban population size from 15 per cent in 1960 to 40 per cent in 2010: with cities like Lagos, Kinshasa, Addis Ababa metamorphosing into megacities of over 10 million inhabitants each (Enisan and Ogundiran, 2013; UN-Habitat, 2015a). Although a decline is expected in urbanisation level in other parts of the world, population growth will continue in SSA at a pace twice the rest of the world (United Nation Department for Economic and Social Affairs UNDESA, 2019). Nigeria for example with a rapid urbanisation rate of 5.5 per cent (Federal Ministry of Lands Housing and Urban Develpoment FMLHUD, 2014), is one of the highest in the world (see figure 1.2).

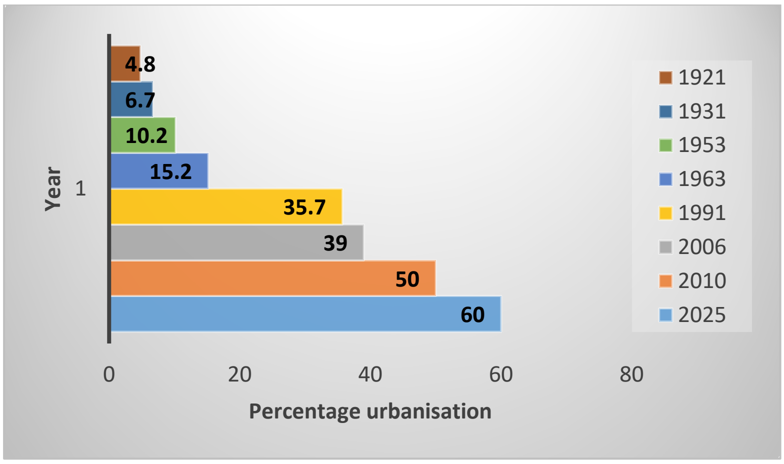

Figure 1. 2: Proportion of current and projected urbanisation in Nigeria
Source: after FMLHUD (2018) dataset

Within a period of 30 years (1952-1982), major urban centres in Nigeria (especially metropolitan Lagos which is the focus of this study) have experienced a five-fold increase in population (Onibokun and Faniran, 1995). By 2025, it is projected that 60 per cent of inhabitants in Nigeria will be living in urban centres (FMLHUD, 2014).

However, as urbanisation continues to grow, with potential negative consequences on the urban dwellers and the surrounding ecosystems, at an alarming rate (Girardet, 2015; Lehmann, 2015), the urgency to focus on systematic approaches and methods to assure sustainability in urban places such as in Nigeria becomes apparent. This presents two fundamental challenges about the future sustainability of cities in Nigeria: one to do with process, and the other with substance. In terms of process, what mechanisms will help deliver sustainable urban areas? In terms of substance, what are the substantive characteristics and/or elements of the framework for decision-making? Given that delivering sustainable urban places will require decision-making that explicitly integrates sustainability, systematic efforts and focus must be directed at NSAF, as a framework for achieving this aim. This requires an indicator set which is fit-for-purpose in the Nigerian context, through which sustainability aspects are integrated and communicated. The poor articulation or absence of such indicator set for decision-making raises three main concerns: One, how will the projected urban population increase in Nigeria by 2050 (UN-Habitat, 2016) be accommodated within the constraints of sustainability? Two, how will stakeholders identify and prioritise the various sustainability aspects of a new neighbourhood? Three, how will this approach to delivering urban sustainability be objectively assured, monitored and its continuous development and evolution pursued?

1.1.5 The Role of Urban Neighbourhoods in Nigeria

Urban neighbourhoods in Nigeria can play a determining and significant role, acting as the principal building blocks to promote sustainable futures. This assumption derives from three main lines of arguments. One, conceptually and as established in other contexts, the neighbourhood remains a significant planning unit of urban area amongst other scales of planning like the building, city, and regional scales (United States Green Building Council USGBC, 2018). Two, from a practical and operational perspective, the decision-making framework for planning, design and approval at the neighbourhood scale of spatial planning, is already in place in various context with an appreciable improvement in delivering sustainable neighbourhood. Therefore, inserting a step to integrate sustainability does not require the creation of a new and extra tool. Three, from a futuristic and transformational perspective, if the projected rapid levels of urbanisation by 2050 and onwards, are to be sustainable, then the absence of an assessment framework for decision-making to steer this will likely frustrate this goal.

Consequently, Berardi (2013), Yigitcanlar et al. (2015), and Dawodu et al. (2017) have canvassed for the definition of the systems and indicators for assessing the sustainability credentials of urban neighbourhoods in developing countries especially in Nigeria which can be used in the decision-making process of planning new neighbourhoods. This is based on the arguments that the decision-making processes around the development of the neighbourhood will be forward-looking and concerned with factors and sources for long-term sustainability in the area. It would also focus on how to integrate urban sustainability principles, objectives and targets, to facilitating and ensuring the delivery of sustainable urban areas. However, in the absence of any such systematic and comprehensive framework for decision-making, how will the envisioned urban area be delivered?

1.2 Problem to be Addressed

This study is underpinned by the problem that the growing population in urban areas in Nigeria call for an approach and mechanism for decision-making that will enhance planning for their sustainable development. In the absence of this, there would be little certainty on how to trade-off and balance competing interests and ideas; and how to calibrate the aspirations, means and delivery mechanisms with the futuristic solutions that are sustainable given the implications of urbanisation in Nigeria. Therefore, with decision-making at the heart of planning, it is feared that a lack of evidence-driven decision-making approaches can lead to unsustainable urban development.

The current situation suggests the urgency to integrate some sustainability aspects in the decision-making framework that could help address the social, economic, cultural, and environmental challenges. For example, waste management takes a prime position as a result of the rapidly growing population where the rate of waste generation per head immensely outgrows the capacity to evacuate the waste (Akinbamijo, 2006; Adejobi and Olorunnimbe, 2012; Gbadegesin and Aluko, 2010). This is because most neighbourhoods do not have efficient waste management and collection scheme. A study by the Lagos State Metropolitan Transport Authority revealed that vehicles contribute about 43 per cent ambient air pollution in Lagos warranting the need to adopt an eco-friendly mode of transportation. In terms of infrastructure, only 50 per cent of the population has access to safe water and over 60 per cent do not have access to basic sanitation (Pepple, 2012).

The existing mechanism for the delivery of neighbourhoods in metropolitan Lagos which can be discussed under the policy, regulatory, and institutional frameworks as treated in detail in section 2.9 has some shortcomings which perhaps is responsible for the current situation in the city. For instance, there appears to be no policy (document) dedicated for enhancing sustainability at the neighbourhood level. Also, key inistitutions like a Green Building Council as observed in other contexts has not yet being established in a growing city like metropolitan Lagos. The Lagos State Physical Planning and Development Regulations of 2005 which is currently the regulatory framework has little consideration for integrating sustainability aspects in planning new neighbourhoods.

As a result, a NSAF which can enhance decision-making at the neighbourhood scale based on an empirical study is presently lacking. Moreover, current NSAFs for decision-making have been developed in western countries, for the sole purpose of addressing issues in their respective contexts (USGBC, 2018). This suggests that they are ‘tailor-made’ and context-specific (Komeily and Srinivasan, 2015; Wangel et al., 2016), making the idea of adopting any of these frameworks for use in another context, like Nigeria, challenging and problematic. This raises the question of what characteristics would the indicators of a framework suitable for the Nigerian context have? The Longman Dictionary of Contemporary English (2009:269) defined the term characteristic as “*a quality or feature of something or someone that is typical of them and easy to recognise*”. In this study, it refers to, but not limited to the attributes of the indicator set and what differentiates it from those of the western world emphasising how context affects and shapes the sustainability indicators. The exploration of such characteristics is of value because it helps to understand the meaning of a sustainable neighbourhood in a particular context and how its indicators are calibrated based on values, needs, and aspirations of relevant stakeholders.

1.3 Research Gap

Several studies on how to deliver sustainable urban areas have been conducted globally (Ilesanmi, 2010a; Joss et al., 2015; Sharifi, 2016; Sharifi and Murayama, 2015). However, there is no evidence of a comprehensive and systematic study investigating the characteristics of a context-specific indicator set of a NSAF for decision-making that could steer urban sustainability at the neighbourhood scale in Nigeria and SSA at large. Yet the Nigeria and SSA context are clearly different in terms of culture; policies; social needs, visions and aspirations; demography; and climate etc.

Although some relevant studies can be found in Nigerian literature, they nevertheless do not provide a comprehensive treatment of the issue. Olotuah and Bobadoye (2009) reviewed the public-sector intervention for housing provision for the urban poor in Nigeria and recommended a bottom-up approach where participation of local communities will be vital for sustainable housing provision. Dimuna and Omatsone (2010:148) posited that sustainable development can be achieved in Nigeria through the mobilization of all relevant agencies coupled with the integration of our vernacular traits of 'communal living' into contemporary efforts at urban regeneration programmes. Okpoechi (2014) and Ihuah and Eaton (2014) identified the functional requirements and sustainability factors for public housing neighbourhoods in Nigeria. Jiboye (2009; 2010), Clement (2012) and Ibem and Azuh (2011) examined residents' perception and satisfaction with urban neighbourhood. Ibem et al. (2015), Jambol et al. (2013); and Ibem and Amole (2010) examined the urban challenges in Nigeria and concluded that critical to the success of housing delivery at the neighbourhood is the consideration for sustainability parameters. Adedeji et al. (2010) recommended an effective usage of modern building materials in respect of the climate change scenario in hot and humid regions of Nigeria to enhance a sustainable built environment. Nwokoro and Onukwube (2011) were of the opinion on the need for a framework to enhance sustainable construction through proper consideration for an integrated design process coupled with the existing environmental assessment and management systems.

This study is therefore driven by the need to bridge this knowledge gap by exploring the characteristics of the indicators of a NSAF through empirically-based research on stakeholders' perceptions and preferences. Perception in this study means the way in which something is understood or interpreted, while preference is showing a greater liking for one alternative over another or others. Stakeholders are those who affect or are affected by a neighbourhood development. In this context, they include two main groups of actors which are the totality of the relevant key players in neighbourhood planning:

(i) Those involved in the decision-making process of a new neighbourhood, otherwise known as experts. They include institutions as either regulators or developers; built environment professionals; and academia.

(ii) Residents who are consumers of neighbourhood development (otherwise known as non-experts).

1.4 Research Question

The research question that guides this study relates to the characteristics of indicators of a NSAF that could guide decision-makers in considering and delivering sustainable neighbourhoods in metropolitan Lagos, Nigeria. Specifically, how does the context of Lagos, Nigeria, being different from that of the western world where current NSAFs originate and operate, affect the nature of indicators that can be used in the decision-making process of a new neighbourhood? Therefore, exploring the various aspects and dimensions of an indicator set derived from, and considered appropriate for the Lagos context will help address the research question.

1.5 Research Aim and Objectives

This study aims to explore the characteristics of indicators of a NSAF that can be used in the decision-making process in the development of neighbourhoods in metropolitan Lagos, Nigeria.

To achieve the stated aim, the following research objectives are pursued:

(i) Identifying generic sustainability indicators at the neighbourhood level from literature to become a departure point for testing to what extent they coincide with those selected in Lagos;

(ii) Exploring stakeholders' understanding of the concept of a sustainable neighbourhood in metropolitan Lagos;

(iii) Establishing the indicators of a decision-making framework for metropolitan Lagos as influenced by the context-specific perceptions and preferences of stakeholders;

(iv) Validating the developed indicators by testing their potential usability and adoptability, whilst identifying the likely barriers of their uptake for decision-making;

(v) Establishing how contextual factors of Lagos influences characteristics of the selected indicators

1.6 Research Assumption

This study is guided by two key assumptions: One, that a neighbourhood is a product of a decision-making process from its planning stage to the point of delivery and subsequent acceptance by the end-users (Moroke et al., 2019; Waas et al., 2014). The implication of this is that the decision-making process serves as a window to integrate sustainability aspects at various stages of development for the new neighbourhood. Two, the decision-making process needs context-specific guiding indicators that capture the aspirations, needs, and values of all stakeholders in its development. This assumption, therefore, negates the idea of importing existing indicator set from NSAFs developed and used in other contexts, making the study context-dependent for data. Subsequently, It is expected that the characteristics of such indicators will differ significantly from those of NSAFs from the western world.

1.7 Metropolitan Lagos

Lagos is located geographically in South West, Nigeria in West Africa (figure 1.3), with the southern boundary of the state framed by around 180 kilometres along the Atlantic coastline, while it is bounded in the east and in the north by Ogun State (Oduwaye, 2009; Okwuashi and Ofem, 2012).

Figure 1. 3: Location of Lagos in Nigeria and West Africa
Source: Encyclopaedia Britanica, 2020

Lagos, named after the Portuguese word ‘Lagoon’ emerged in 1861 has served as the Yoruba Port, the British political centre, and the capital of Nigeria. Early migrants to Lagos were the Aworis in the fifteenth century when the city was called ‘Oko’. The name ‘Eko’ emerged when the Awori settlement was conquered by the Benin Empire which made the Island become a Benin war-camp. After the amalgamation of the northern and southern protectorates in 1914, Lagos became the capital city of Nigeria. It also served as the capital of Lagos state when the state was created in 1967, until 1976 when the state capital was moved to Ikeja. Lagos ceased to be the Federal capital in 1991 when Abuja was declared the new seat of the Federal Government.

1.7.1 Population Growth and Local Governance

Lagos has grown to become a metropolis and officially known as 'Lagos Metropolitan Area'. Although the metropolitan Lagos is only 37 per cent of the Lagos state landmass, it houses at least 85 per cent of the total state's population and about 10 per cent of the country's population. With a population density of 5926 persons per square kilometre, it is Nigeria's most cosmopolitan and most over-populated city (Oshodi, 2013; Komolafe et al., 2014). Metropolitan Lagos became a mega-city in the closing decades of the twentieth century (Ilesanmi, 2010a). A mega-city according to UNDESA (2016) is a continuous urbanised area with a population of at least 10 million people. At present, with an annual increase of 275,000 persons per annum, the population of metropolitan Lagos is around 19 million (Lagos State Government LASG, 2016). On the global scene, Lagos is ranked as the 17th most populous city and is one of the fastest urbanising areas in the world with the population figure put at 13,661,000 (UNDESA, 2016). It has a strategic role in relation to other West Africa countries as a leading regional port and manufacturing centre with the highest number of multinational companies (Philips and Horwood, 2007).

The metropolis was initially managed by the Lagos City Council, until 1976, when it was divided into Local Government Areas. Presently, the Lagos Metropolitan Area is made of 16 Local Government Areas out of the 20 Local Government Areas in the entire state (figure 1.4).

Figure 1. 4: Map of the Local Government Areas of Lagos
Source: Bohr, 2006 / CC BY-SA (http://creativecommons.org/licenses/by-sa/3.0/)

The projection by the United Nations (UN) that metropolitan Lagos will be the 9th most populous country in the world by 2030 with an estimated population of 24, 239,000 leads to a question of how the growth can be sustained in the absence of a substantive and a procedural framework to integrate sustainability aspects in the decision-making process of a new neighbourhood development having established the strategic role of urban neighbourhoods.

1.7.2 Neighbourhood Development and Typology

Neighbourhoods in metropolitan Lagos can be discussed in terms of their spatial development as either a master-planned or piecemeal development. The master-planned development which is a large scale housing delivery either by the government or private institutions can be categorised as either: a single housing estate (e.g. three-bedroom flats only) where an individual or family occupies a detached dwelling (figure 1.7 and 1.8); or mixed-housing estate whereby a single building known as a 'block' (figure 1.5) by virtue of its design can accommodate more than one family.

Referred to as "mass housing" by the National Housing Policy as captured by Ocholi et al. (2015), the master-planned development is a process of simultaneous production (building) to targeted prices of a large number of decent, safe, sanitary, and affordable residential buildings with secured tenure; on a continuous and permanent basis with adequate physical infrastructure, amenities and social services in a planned, healthy and liveable environment to meet the basic and special needs of the population and reflecting their socio-economic, cultural aspiration, and preferences.

In recent times the master-planned neighbourhood developments by government institutions, have continued to dominate the housing sector in metropolitan Lagos due to the active involvement of the government to reduce the housing deficit. This is because most developments by private institutions are targeted mainly at high-income earners where maximum and immediate profit can be realised. The involvement of the government in public housing dates to 1929. It started with the establishment of the Lagos Executive Development Board (LEDB) which later transformed to the Lagos

State Development and Property Corporation (LSDPC) (Omolabi and Adebayo, 2017). The general goal is to enhance access to decent and affordable homes. However, most government master-planned neighbourhood developments have been for the upper-middle class in what is called ‘luxury affordable flat’ (figure 1.6).

Figure 1. 5: A master-planned neighbourhood development in metropolitan Lagos built in 1977
Source: Author, 2018

Figure 1.6: The MKO gardens in metropolitan Lagos
Source: Author, 2018

The master-planned neighbourhood developments by private institutions are because of an "organised" and "unorganised" private sector real estate companies which are involved in housing delivery (Agbola et al., 2012) whilst seeking the maximum possible return on investment. The organised private sector belongs to the Real Estate Development Association of Nigeria (REDAN). The neighbourhoods that emerge from the activities of the organised sector are mainly targeted to the medium and high-income group of the society (figures 1.7 and 1.8). Examples of organised private companies that have engaged in developing neighbourhood schemes in metropolitan Lagos include HFP engineering (Nig.) Ltd responsible for the planning and the design of the Victoria Garden City, May fair Gardens, and fountain Springville Estate; Sparklight property development company Ltd; and recently Lekki Gardens.

Figure 1. 7: A private master-planned neighbourhood development (VGC estate) in metropolitan Lagos
Source: Author, 2018

Figure 1. 8: A private master-planned neighbourhood development (Ocean Bay estate) in metropolitan Lagos
Source: Author, 2018

A piecemeal neighbourhood development type is formed from individuals who build own houses. As the name implies, they are built in ‘pieces’ of single houses in the same area until it grows to form a neighbourhood. However, they are most times supported with basic amenities and facilities from the government. In this arrangement, the layout is designed from which plots are sold to prospective buyers. It basically involves dividing the lots into blocks, and plots, indicating the land use pattern and access roads. The piecemeal neighbourhood typology encourages a variety of designs from the prospective household owners, unlike the master-planned neighbourhood which is usually of a single design (figures 1.9).

Figure 1. 9: A piecemeal neighbourhood development (Iyana Ipaja area) in metropolitan Lagos
Source: Author, 2018

1.7.3 Master Planned Typology as Focus of Study

This study will focus on the master-planned neighbourhood (also known as housing estates) for two main reasons. Firstly, it is at this scale of planning, involving large areas and several users, that the principles of sustainable neighbourhoods can best be operationalised and assessed in terms of socio-cultural, economic, and environmental issues (Berardi, 2013; Wangel et al., 2016). This is unlike the piecemeal development where planning and decision-making are only carried out at the single building scale with limited footprints in terms of area and users. Secondly, most government interventions in terms of housing schemes in metropolitan Lagos are executed at this typology of mixed housing estates as opposed to piecemeal housing (Ibimilua and Ibitoye, 2015; Jaiyeola, 2012; Omolabi and Adebayo, 2017) through its various institutions such as the Lagos State Development and Property Corporation (LSDPC); Ministry of Housing; and Lagos Building Investment Company amongst others. The LSDPC for instance as at 2006 has built a total number of 20572 units in 23 neighbourhoods. Also, the Ministry of Housing delivers an average of 1250 housing units per year (Hoelez, 2016).

Therefore, empirical focus on this typology will potentially contribute to a significant proportion of neighbourhoods and likely to promote urban areas that are sustainable building block by building block.

1.7.4 Challenges of Urban Sustainability

The oil boom in Nigeria witnessed in the 1970s was responsible for the rapid population growth in Lagos which was characterised by uncontrolled development because of the mass rural migration. Scholars are of the opinion that the dynamics of city growth in metropolitan Lagos have been accompanied by enormous deficiencies in modern basic amenities and facilities (Agbola et al., 2012; Emza and Oluwatayo, 2014; Owoeye and Omole, 2012; Omole and Akinbamijo, 2012) due to the fact that the increasing urban population growth rate has not been complemented by adequate planning and statutory framework to accommodate such growth (Akinbamijo, 2006; Olurin and Jiriko, 2012; Opoko and Oluwatayo, 2014).

Lagos is confronted with several environmental challenges, one of which is sanitation. With a high house occupancy ratio ranging from 4 to 5 persons per room, most of the dwellings lack toilet facilities, with occupants having to use facilities situated outside the main building with no drainage (Komolafe et al., 2014; Basorun, 2003). In addition to this, the increasing growing human activities in metropolitan Lagos especially with the emission of greenhouse gases (from dumpsites, power generators, and open incinerators) resulting to air pollution has contributed to the environmental challenges. This has been responsible for the loss of lives and respiratory disorder in children and adults due to increased carbon monoxide (Olowoporoku et al., 2012). Besides the air pollution from the manufacturing industries, the urban transportation sector accounts for the highest contribution to both air and noise pollution (Komolafe et al., 2014). The gradual accumulation of greenhouse gases in the atmosphere has also led to increased temperature and rise in sea level. This, on the other hand, has resulted to flooding from excessive rain which is a major environmental challenge in Lagos rendering so many people homeless and destroying properties (Gbadegesin et al., 2011; Oshodi, 2013). Health challenges of water-borne diseases associated with water pollution from several incidents of flooding are also persistent (Sujaul et al., 2013; Komolafe et al., 2014).

Neighbourhoods in metropolitan Lagos are also confronted with social challenges in terms of infrastructure, safety, social inclusion, equity, and respect for diversity and cultural identities (El Din et al., 2013). The few available infrastructures are under immense pressure (UN-Habitat, 2015b) due to the rural-urban migration. It is impossible to plan for a sustainable neighbourhood without provision of the necessary infrastructures as they are essential to enhance the standard of living and facilitates or catalyses economic growth. The Neighbourhoods are also characterised with inadequate provision for security of lives and property. This social unrest and insecurity can be traced to the breakdown of family cohesiveness, social ties, cultural values, and community spirit typical of the African neighbourhood coupled with the high rate of unemployment with little support for the local economy (Momodu et al., 2012).

In terms of economic challenges, the issue of home affordability has been a major concern. Low and middle-income earners can hardly have access to decent housing which has resulted in the development of slums in suburbs in some parts of metropolitan Lagos (Pepple, 2012). Also, there is inadequate support for the local economy in terms of provision of retail outlets. Another prime economic challenge is the high cost of maintaining these neighbourhoods. Most of them are not built with durable material thus requiring occasional maintenance (Ibem and Amole, 2013).

These challenges raise a question of what mechanism can enhance the integration of sustainability aspects in the decision-making process of a new neighbourhood that would deliver urban sustainability at the broader scale in metropolitan Lagos. It teases the question of the characteristics of the indicators (as such mechanism) that could be helpful to address these concerns to deliver a sustainable Lagos. This is also because metropolitan Lagos is not in the top 100 global cities in the sustainable cities index which ranks cities using the three dimensions of social, environmental, and economic sustainability (Arcadis, 2018). Only few African cities appeared in the index with an unimpressive position (Johannesburg- 92nd, Nairobi- 96th, Cape Town- 97th, and Cairo- 99th).

1.8 Potential Benefits of Study

This study would enhance a better understanding of the relevant NSAF indicators in terms of their characteristics. This is because the characteristics of an indicator carry information as to what aspect or dimension of sustainability is being prioritised or considered; thus enlightening the decision-makers on what in a neighbourhood might be playing a key role in creating more sustainable urban areas. Therefore, insight from this study would contribute to both the theory and practice of urban sustainability, especially in relation to neighbourhood planning in metropolitan Lagos. If it turns out that the majority of indicators selected are weak in addressing flows which are key to gauging sustainability, then there is a valid reason to approach the Lagos-customised NSAFs in a way that remedies that condition. Also, as a rich source of information on the nature of the indicators, it is indeed a starting point from which more ambitious calibration can be based. For example, where there are deficits (e.g. fewer indicators), more can now be inserted. Theoretically, it would further ground and concretise the concept and interlinkage of the context-specific nature of sustainability, and associated sustainability assessment frameworks as a vehicle to deliver sustainable neighbourhoods. Practice-wise, it would provide a robust basis for an evidence-based and predictable outcome in designing and planning of new neighbourhoods, and ultimately delivering sustainable urban areas. For example, in neighbourhood planning and development, the practitioners will have an easy-to-use tool to address otherwise complex and almost intractable issues of considering and delivering sustainability in the projects that they engage in.

The bigger picture is that the projected future urban areas will now be delivered within a decision-making system and strategy that integrates sustainability aspects which is fit-for-purpose for the metropolitan Lagos contextual conditions. This will facilitate an efficient and more effective approach in addressing the challenges of urban sustainability going forward.

Perhaps, other SSA urban areas experiencing similar challenges as Lagos can have a benchmark and canvass of lessons, for reflecting on how they can seek to deliver their own more sustainable urban areas.

1.9 Overview of Research Methodology

This study adopts a critical realism philosophical stance which advocates that knowledge can be sourced (epistemologically) through the perception of people with respect to an underlying structure (Easterby-Smith et al., 2012; Saunders et al., 2016). Survey as a research strategy was adopted to address the research objectives using appropriate data collection techniques. The need for both textual and numeric data to address the study aim informed mixed-method research.

The following techniques were used to address the research objectives:

- Literature review to map and identify key sustainability indicators at the neighbourhood level (Qualitative).
- Questionnaire survey to: (i) explore stakeholders' understanding of the concept of a sustainable neighbourhood and their perception of its indicators; and (ii) to validate the indicator set of a NSAF in terms of its usability, adoptability, and acceptability for decision-making in metropolitan Lagos (Qualitative and Quantitative).
- Analytical Hierarchy Process (AHP) to establish stakeholders' preferences of the sustainability indicators (Quantitative).

1.10 Theoretical Framework

This study can be understood within three key theoretical boundaries which offer the knowledge and cause-effect frameworks which underpin the study. These are: the neighbourhood theory; decision-making theory; and context-specific nature of sustainability indicators as illustrated in figure 1.10 and further discussed.

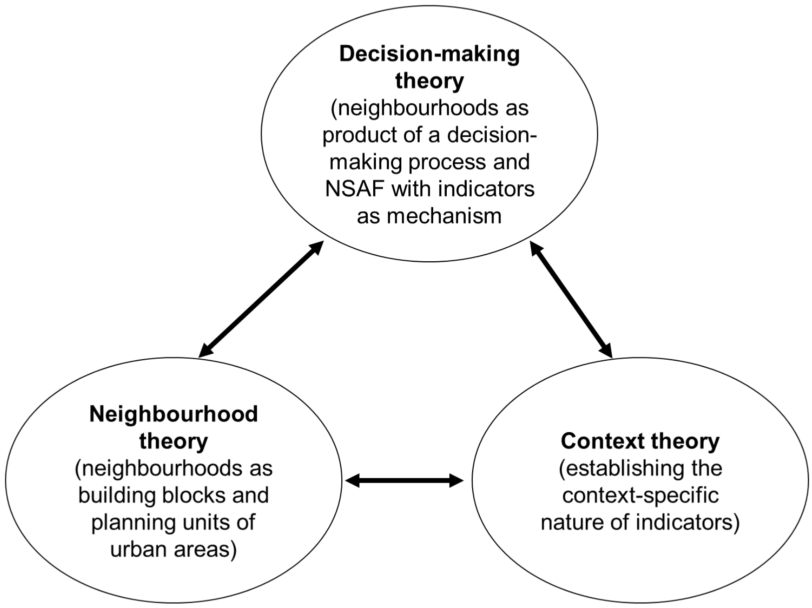

Figure 1. 10: Theoretical framework of study
Source: Author, 2020

The *neighbourhood theory* as espoused by Isaacs (1948), drew inspiration from the works of Ebenezer Howard, Clarence Perry, Clarence Stein, and Henry Wright (section 2.4.2). The theory postulates that the neighbourhood by virtue of its size and connectedness to other scales of spatial planning could be a suitable scale for planning cities. Its key elements state that neighbourhoods are building blocks of urban areas. What this means, is that if the components parts which are the neighbourhoods are well-planned, this would have an overall cumulative and multiplier effect. This theory serves the purpose of explaining the current focus on neighbourhoods in the vision for urban sustainability (Ferwati et al., 2019; Moroke et al., 2019). However, to do this, one recognises key discourses which established that neighbourhoods are themselves products of a dedicated decision-making process involving both procedural and substantive aspects (Caratti et al. 2004; Bosch et al., 2017). This process provides an avenue and platform for integrating sustainability aspects at the various decision windows prior to the actual development of the neighbourhood. This understanding is linked to the *decision-making theory* because it involves a cognitive process that results in a selection of a preferred option after weighing and considering several alternatives (Wang and Ruhe, 2007). For example, bounded rationality is a common form of a decision-making process model that is based on practical considerations and exigencies of existing knowledge and corresponds with the real world practical decision-making process (Kalantari, 2010). It is within such a decision-making context, that NSAFs, with indicator set deployed as key component and mechanisms for decision-making, are developed and applied in various contexts (Joss et al., 2015).

Finally, decision-making is not undertaken in a vacuum (Kalantari, 2010), making the role of context crucial in influencing the concept of neighbourhoods, sustainable neighbourhoods, and ultimately the indicators associated with the notion of a sustainable neighbourhood. While NSAFs originated from the west with peculiar sustainability challenges, needs, visions, and aspirations, they cannot, therefore, be applied directly for use in another context for decision-making (Joss et al., 2015; Gazzola et al., 2011; Gazzola, 2008; Fischer, 2005; Fischer and Gazzola, 2006; Fischer and Onyango, 2012). This is because decisions are taken with consideration to the underlying context to ensure that such decisions address the needs of the relevant stakeholders. This suggests that the decision-making mechanism that would deliver such a concept like sustainability has to be context-driven. Therefore in this study, it is argued that the indicators selected for the NSAF, will be a result of a process that would have taken consideration of contextual aspirations, needs, and limitations, to arrive at them.

1.11 Conceptual Framework

The conceptual framework as a key part of a research is a visual or written work that highlights the links between all the elements of the study (Miles and Huberman, 1994). It encompasses the systems of concepts, beliefs, and assumptions that form a basis for the research work, providing a justified rationale for data collection, analysis and interpretation of findings to address the research problem. The study is informed and motivated by the acknowledgement of the role of urban neighbourhoods as crucial in the battle for future sustainability (Wangel et al., 2016; Berardi, 2013); albeit in a context in which empirically established indicators that can enhance formulation and delivery of urban neighbourhoods is lacking. Here, decision-making theory as a strategy has facilitated the stakeholder-driven search for context-based indicators, guided by analytical and deductive approaches to data analysis, to derive appropriate indicator set.

The stakeholders have been carefully selected to represent a potentially relevant group of interests in a future decision-making framework to deliver sustainable neighbourhoods; applied at the identification of the initial set of indicators, and during the validation stage of the selected indicator set before their characteristics are then explored. A critical realism lens provides a perspective to understand and interpret the indicators. The conceptual framework is illustrated in figure 1.11. The central argument lies around evidence-based decision-making, aided by empirically established indicators, whose characteristics are understood, which can guide NSAF formulation for delivering sustainable urban neighbourhoods. By establishing the characteristics of selected indicators, a basis for understanding their strengths and weaknesses is thereby founded, allowing for subsequent remedial intervention to finally deliver a more appropriate indicator set. The exercise in establishing the characteristics serves as a mechanism to gauge “deficit” between perceptions of stakeholders and more objectively appropriate approach in the development of indicator set so that a more useful set of indicators can be formulated.

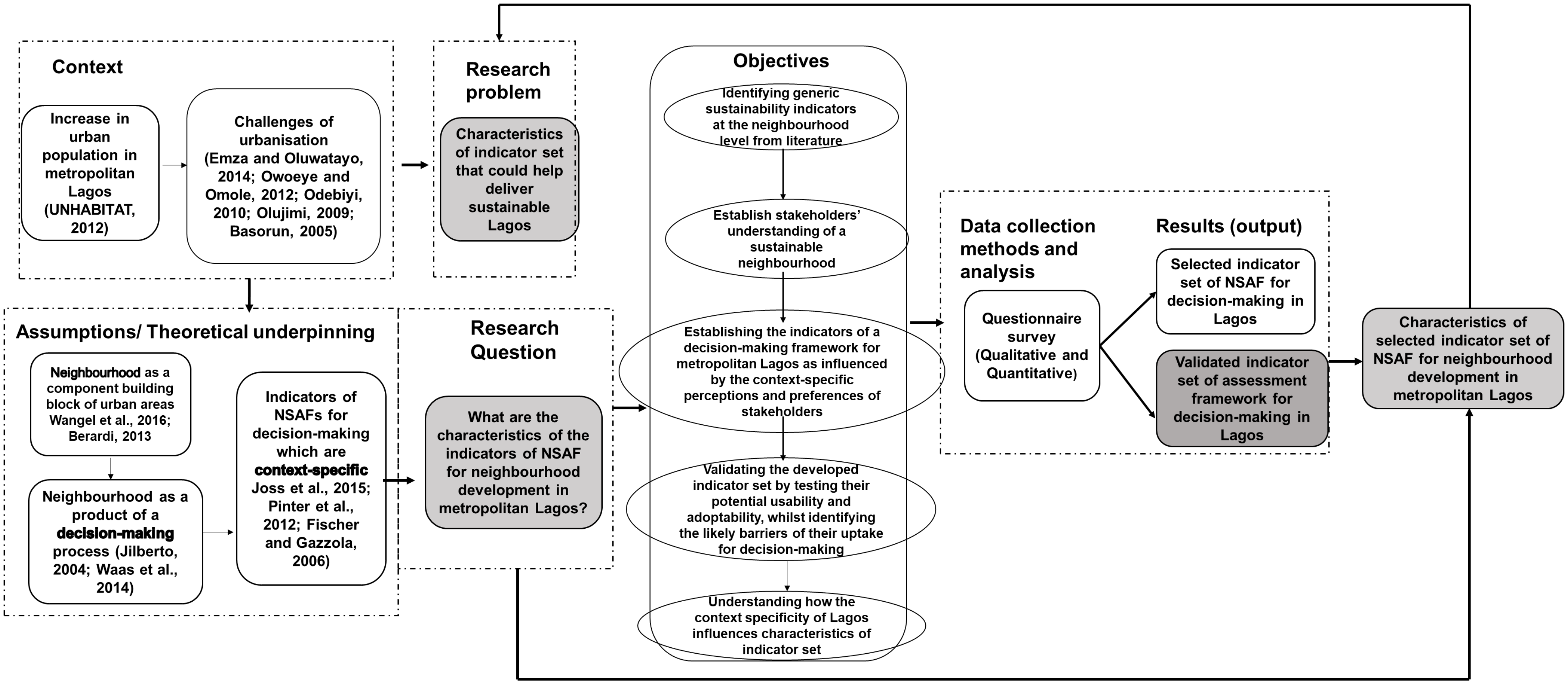

Figure 1. 11: Conceptual framework of study
Source: Author, 2020

1.12 Structure and Outline of the Dissertation

Chapter 1 (Introduction) presents the background and context of this study. It addresses the key challenges of urban sustainability from the literature that led to the identification of the research problem. It highlights the knowledge gap that is to be addressed and the key question that the study seeks to answer. It concludes by highlighting the potential benefits of the study while also giving an overview of the methodological approach.

Chapter 2 (Literature review) situates the study in a wider discourse including appropriate theories guiding the study. These include sustainability and its application for planning; and the role of neighbourhoods in urban sustainability. The chapter further reviews NSAF as a decision-making strategy as applied in various contexts having earlier established the challenges of decision-making for urban sustainability. It reviews the complexity, approaches and key principles for the development of indicators of a NSAF. The decision-making framework for neighbourhood development in metropolitan Lagos was presented with a focus on its policy, regulatory, and institutional aspects to identify the extent of sustainability consideration in the decision-making process. The chapter concludes by extracting indicators for a sustainable neighbourhood to deliver research objective 1 as the starting point for the empirical phase of this study.

Chapter 3 (Methodology) explains and presents the approaches, strategies, and methods applied to the study starting from the philosophical underpinning which provides a lens for interpreting the research findings, to the detailed steps and procedures for data collection and analysis. The reliability and validity of the research design were further examined, and the ethical considerations discussed.

Chapter 4 (Results and findings) delivers research objectives 2, 3, and 4. As a result, it presents both institutional stakeholders' and residents' understanding of a sustainable neighbourhood in metropolitan Lagos. It further captures their perceptions of its indicators in terms of their importance in contributing to a sustainable neighbourhood through which the indicators that could be useful in the decision-making process of a new neighbourhood in metropolitan Lagos were selected. The chapter presents results from the various categories of the stakeholders to establish the patterns in their perception. It presents stakeholders' aggregated preferences of the selected indicators using the Analytical Hierarchy Process (AHP) which was helpful in the ranking of the indicators and assigning an aggregate weight from which a sustainability index was developed. The chapter also presents the results from the validation of the indicator set about its adoptability and usability for decision-making at the neighbourhood level in metropolitan Lagos. The chapter further delivers characteristics of the indicator set based on the findings.

Chapter 5 (Discussion) discusses the implications of the findings from the study. It establishes the findings in relation to the wider body of knowledge discussed in the literature review. The chapter explored the characteristics of the indicators (as presented in chapter 4) and the influence of metropolitan Lagos to deliver research objective 5. The limitations of this study were highlighted while areas for future study were identified.

Chapter 6 (Conclusion and Recommendations) presents the conclusions and recommendations of this study highlighting the key inferences from the research objectives. Also, the aim and the research question were revisited to ensure that it has been addressed.

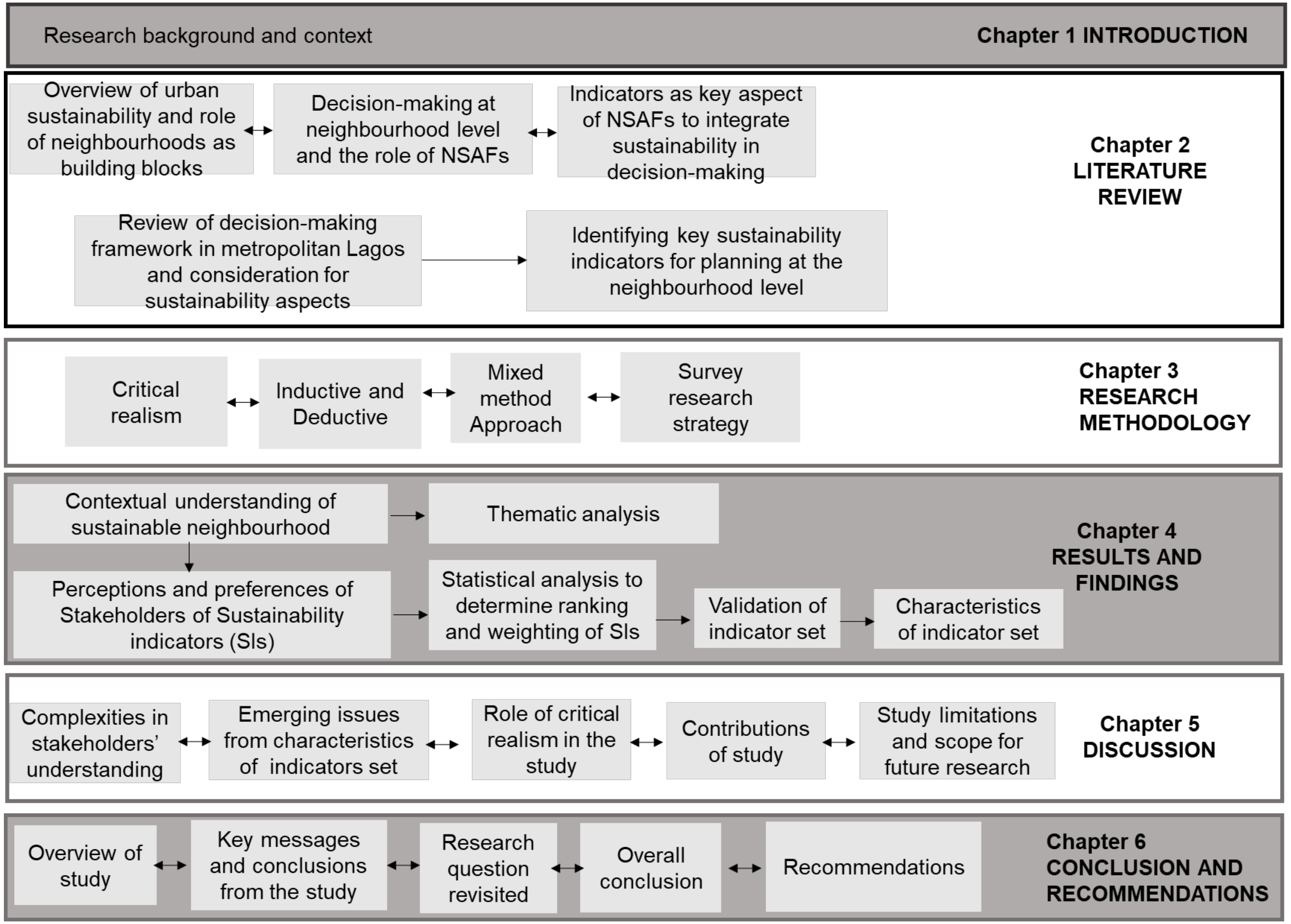

Figure 1. 12: Outline of the dissertation
Source: Author, 2020

CHAPTER 2 LITERATURE REVIEW

This chapter reviews the key discourses relevant to this study to establish it within the wider body of knowledge, while also justifying the research gap. It attempts to understand the concept of sustainability, and how it relates to planning at the urban scale looking critically at the existing paradigms, and related concepts. It reviews arguments on the position of the neighbourhood as a scale to be given consideration in planning for urban sustainability because they serve as the building blocks of cities. Adopting decision-making as the main theory guiding this study, the chapter presents the challenges of decision-making for urban sustainability and the characteristics of the indicators of the Neighbourhood Sustainability Assessment Frameworks (NSAFs) through which the challenges of decision-making have been addressed in various contexts. The chapter concludes by delivering research objective 1 which is to extract generic indicators for neighbourhood sustainability, after establishing the need for metropolitan Lagos to have such integrated mechanism at the various decision-making windows in planning for sustainable neighbourhoods. The extraction process which involves a document analysis (including cross-referencing) of international to local global agenda on sustainability was in two main stages as captured in this chapter. First was the identification of sustainability themes that can be demonstrated at the neighbourhood scale. Second was identification of indicators which can be helpful to implement the themes in a proposed neighbourhood development. The generic indicator set was further presented to stakeholders to establish their perception and preferences to select suitable indicators for metropolitan Lagos as captured in chapter 4.

2.1 The Concept of Sustainability

2.1.1 Historical Overview

The term ‘sustainable development’ is traceable to the early study carried out by Barbara Ward and Renes Dubos in 1972 (Gibson et al., 2005) in response to the 1972 conference on the human environment on the urgent need to begin to chart a new course in reconciling environment and development. This is because of the increasing environmental degradation, poverty, and decline in wellbeing. This suggests that at the heart of sustainability is the concern for both the continued existence of the environment and man's prosperity. This understanding heralded the term 'our common future' in the 1987 conference where the relationship between development and the environment was re-echoed (World Commission on Environment and Development WCED, 1987). Stakeholders at the conference for example, strengthened the argument that man's wellbeing and environmental integrity are crucial and inseparable to deliver sustainable development (Gibson et al., 2005; Deakin and Curwell, 2004). Pursuing the sustainability agenda further, the 1992 United Nations Conference on Environment and Development (UNCED) presented the agenda for the 21st century (Agenda 21) which set out a detailed action plan to address and tackle various sustainability issues as an alternative approach. As its core characteristics, the Agenda 21 canvassed that each local government should draw its own local agenda, recommending for a participatory approach to planning and development where all stakeholders are engaged (UN, 1992).

The wide acceptance of sustainable development by various stakeholders as an approach to ensure the enhancement of man's wellbeing, while ensuring that developments are within the earth's carrying capacity is evident in various fields of man's activities. These include: transportation (Shi et al., 2019; Faulin et al., 2019), mining (Monteiro et al., 2019; Asr et al., 2019), agriculture (Erbaugh et al., 2019; Adenle et al., 2019), business management (Bocken et al., 2019; Tura et al., 2019), healthcare (Podein and Hernke, 2010; Rodriguez et al., 2019), technology (Promentilla et al., 2018); manufacturing (Kolotzek et al., 2018; Marimin et al., 2018); and the built environment (Cruz et al., 2019; Zebari and Ibrahim, 2016) which is the focus of this study amongst others. The built environment has in recent years has been responsible for a larger of sustainable challenges such as environmental pollution, construction wastes and management, social inequality, and deforestation amongst others (Canning et al., 2019; Fregonara et al., 2016).

2.1.2 A Reflection on Critical Debates

Despite the increased interest in sustainability discourse and its applications in various disciplines, with the terminology gradually becoming the theme of this present age (Huang et al., 2015), there is no consensus as regards the definition of the concept as several definitions have evolved over the years (White, 2013; Berardi, 2013; Komeily & Srinivasan, 2015). The diverse perceptions of sustainability suggest three main themes of (i) improvement in the quality of human life; (ii) development within the earth's carrying capacity; and (iii) meeting the needs of future and present generations. These themes have been influenced by some key critical debates which are reviewed hereafter to establish the position of this study in terms of interpreting its findings.

Is Sustainability a Goal or a Process?

There has been a key argument amongst scholars on whether sustainability is a goal or a process (Bond & Morrison-Saunders, 2013). However, there is a school of thought that suggests that whether the concept is a goal or a process is only a function of terminology. Shen et al. (2011) perceived 'sustainability' as a goal and 'sustainable development' as a process. It is was in this light that sustainable development was defined by the WCED (1987) as a process of change in which exploitation of resources, the direction of investments, the orientation of technological developments, and institutional change are all in harmony and enhance current and future potential to meet human needs and aspirations. In contrast, Edwards (2012) argued that 'sustainability' is a process while 'sustainable development' is a goal. The International Union for the Conservation of Nature (IUCN) seems to agree with this position by defining sustainable development as a development that improves the quality of human life while living within the carrying capacity of the supporting ecosystem'.

In the context of this study, the term will be used interchangeably adopting the similar approach of Bond & Morrison-Saunders (2013) and Pope et al. (2004). However, the study would discuss sustainability as both a process and a goal. This is with the understanding that in exploring the characteristics of the indicators of a NSAF, some indicators will be helpful to address some aspects at the conceptual phases of a new neighbourhood, while some will be helpful to assess the neighbourhood before it is delivered to the end-users.

Which One of the Approaches to Sustainability is Adopted?

Sustainability has been interpreted from four main perspectives as explained by Sala et al. (2015) which have influenced the way it is understood in terms of its scope and what it seeks to address. One is the ecological interpretation which advocates interdependence between ecological processes. This argues that all other sub-systems such as the socio-economic subsystem are embedded within the biophysical system. Although it is very highly contested, this position defined sustainability from the perspective of placing a priority on maintaining the ecological value in the development endeavour of man. Two is the economic interpretation, which argues that intergenerational equity (that is, concern for the need of future generation) can be achieved using capital theory. Three is thermodynamic and ecological-economic interpretations which agree to most of the arguments of the ecological interpretations. However, what differentiates it, is that, it attempts to establish ecological sustainability in the context of the entropic nature of economic-environmental interactions. That is, when there is consideration or balance between economic and environmental concerns. Four is the public policy and planning theory, whose ideology is based on the need for a framework that aims to achieve balance or an integration of the social, institutional, economic, and environmental aspects of sustainability.

This study adopts the public policy and planning theory approach. This it intends to do by advocating for a comprehensive and holistic approach where all issues and aspects relating to ecological, social, economic are integrated into a framework that could deliver sustainability. This is because, in addition to environmental concerns, it is crucial to consider all aspects relating to the wellbeing of the residents to deliver sustainability, most especially, at the neighbourhood level. This perspective further suggests an engagement with relative stakeholders at the decision-making windows of new development because one of its goals is to ensure the common good of the public while the environment is also preserved. This supports Gibson et al. (2005) and Deakin and Curwell (2004) who identified the following eight principles that define sustainability: (i) socio-ecological integrity; (ii) livelihood sufficiency and opportunity; (iii) intragenerational equity; (iv) intergenerational equity; (v) resource maintenance and efficiency; (vi) socio-ecological civility and democratic governance; (vii) precaution and adaptation; (viii) immediate and long-term integration. This understanding and position suggest that the characteristics of the indicators of the NSAF would be explored as regards the integration of and consideration for various sustainability aspects.

Over what Scale of Spatial Development is Sustainability to be Achieved?

How the concept of sustainability is perceived, and the characteristics of its indicators also depends on the scale of spatial development within which it is to be achieved. This could be from the whole city level to that of an individual building, and its constituent materials (Deakin and Curwell, 2004). For example, there is evidence in the literature of sustainable or green buildings (Sev, 2009; Son et al., 2011; Love et al., 2012; Yudelson, 2008). This raises a question of which scale is most appropriate for visioning sustainability. Is it the building, neighbourhood, district or regional scale? However, it is important to know and understand the interlinkages within these spatial scales (as illustrated in figure 2.1) because what happens at the building scale has the potential to affect the neighbourhood, the district, and the city at large (Bell and Morse, 2008).

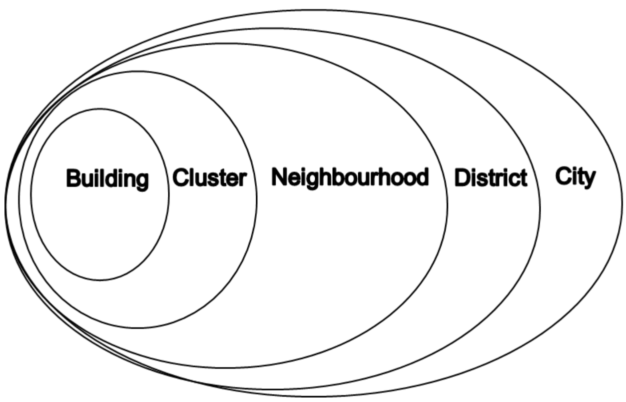

Figure 2. 1: The interlinkages between the spatial scale of spatial development
Source: Author, 2020

This study would focus on the neighbourhood scale which is directly linked to the building and the district scale covering issues covers like mobility, architectural design, layout, and waste control and management amongst others. The neighbourhood scale is important as it can be viewed as the building blocks of cities (Komeily and Srinivasan, 2016). It is perhaps the meeting and central point of the various scales. Additionally, whatever happens at the neighbourhoods in terms of sustainability consideration has the potential of affecting the overall urban area (Gehl, 2013). It is at this scale as well that sustainability aspects can best be assessed most especially as it relates to environmental, economic, and socio-cultural considerations. This is because, for instance, assessment at the building scale of environmental aspects such as waste management and pollution control would not be as comprehensive as the one which involves a group of dwellings. Also, the assessment of such aspects like inclusive planning and design, and outdoor spaces amongst others are perhaps impossible at the building scale. To this end, the indicators which this study intends to explore will be expected to capture aspects that address sustainability at the neighbourhood level to ensure responsive and applicable decisions which have the potential of delivering sustainable Lagos at large.

Over what Time Scale is Sustainability to be Achieved?

The timescale over which sustainability is considered and evaluated is both a part of its definition and a variable by which it is evaluated (Bell and Morse, 2008). There are re-occurring debates on the time horizons for sustainability, taking into consideration that the concept has to do with ensuring equity now and in the future (intragenerational and intergenerational equities respectively). Intergenerational equity has been queried on the basis that any attempt to conserve for tomorrow will result to a compromise of the needs of today's poor (Barret and Grizzle, 1999 cited in Bond and Morrison-Saunders, 2013). It may also be difficult to determine the needs of future generations. Therefore, having a long-term sustainability vision is difficult as even most times, it is based on uncertainty and projection (Bond and Morrison-Saunders, 2013). However, the intragenerational equity which has to do with the present generation is considered by stakeholders. Several time scales have been conceptualised. For example, the Built environment Quality Evaluation for Sustainability (BEQUEST) framework identified 3 main time scales in sustainability. These are short term between 0-5 years; mid-term between 6-20 years; and long term which is above 20 years (Curwell et al., 2005).

This study would attempt to conceptualise sustainability in the short term and mid-term bases. That is, between 0-20 years and 25-80 years. This is because the 20-year short term plan of each of the neighbourhoods has the potential to produce a harmonious rollover of decision-making that will continuously refresh urban sustainability through the NSAF. In addition to this, the main component- sustainability indicators which this study argues that its integration in the decision-making process, has the potential to enhance the delivering of a sustainable neighbourhood, requires some period to monitor its progress before a review can be made based on any identified shortcomings.

Strong or Weak Sustainability?

The term ‘weak’ and ‘strong’ sustainability are two important concepts or approaches in sustainability discourse particularly on the degree of substitutability between natural and human-made capital (Ekins et al., 2003; Wu, 2014). The choice of either weak or strong sustainability has been the basis for which decisions relating to sustainable development are made. This is because they are the most influential paradigms in policy discussion about sustainable development. The choice guides such principles like trade-offs and prioritisation in the decision-making process. Weak sustainability is based on the assumption that future generations require only a total aggregate stock of ‘man-made’ and ‘natural capital’ with no emphasis or priority on natural capital (Neumayer, 2003). It argues for unlimited substitutability between both natural and human-made capital so that a system can be considered sustainable if its total capital stocks are not decreasing (Pillarisetti, 2005; and Fischer et al., 2008). Therefore, this position agrees that a rapidly growing city with an economic boom and declining environmental quality can be considered sustainable. This school of thought which aligns to the economic approach discussed earlier suggests, that there is no need for caution about man's exploration and usage of the present natural resources (either renewable or non-renewable), so far there are tangible and palpable results (such as industries, roads, and bridges among other infrastructures) to justify our actions. The proponents argued that natural capital is surplus and super-abundant and can be compromised both as input into the production of consumable goods or as a provider of direct utility (Neumayer, 2003). A typical example of this instance is when the result of an Environmental Impact Assessment which identified the ecological damage a development might cause is ignored due to the envisaged economic benefits of such a proposal.

On the other hand, strong sustainability which queries the perception of weak sustainability, canvases for a non-substitutability paradigm to sustainability (ibid). It prioritises natural capital and as such, it is of the perception that on no basis should the natural capital be compromised. It is of the view that social capital and natural capital are not exchangeable (Wangel et al., 2016). Neumayer (2003) identified two contrasting meanings of strong sustainability: One, sustainability is a model which calls for ensuring and keeping value terms of the natural capital itself.

This calls for a robust compensation of the natural capital if it is been compromised by man-made capital. It is an ideology that does not advocate for the preservation of the natural capital itself. This is not a good approach to sustainability as it seems to be akin to the idea of natural capital is in abundant. The second school of thought sees strong sustainability as that which advocate for non-substitution of the natural capital under any condition. In contrast, it calls for 'preserving the physical stocks of those forms of capital'.

It is noteworthy that the choice of either weak or strong sustainability shapes the characteristics of the indicator set. For example, an indicator set whereby environmental issues are compromised for social development suggests weak sustainability. Meanwhile, an indicator set can be said to enhance strong sustainability by the weighting and ranking of the indicators that show no compromise for any of the sustainability aspects.

Overall, the understanding of the concept of sustainability suggests four interrelated conclusions (Brandon & Lombardi, 2011; Gibson et al., 2005) which this study aligns with as illustrated in figure 2.2.

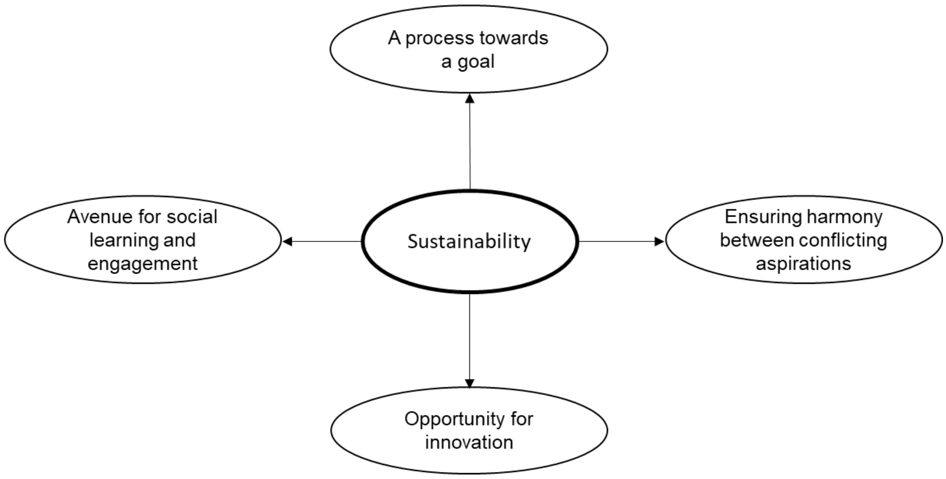

Figure 2. 2: Position of study in critical debates
Source: Author, 2020

- One, sustainable development is not a destination but a process towards a goal either on a short term, or mid-term basis. This suggests that the journey towards sustainability is a continuous one where progress is measured intermittently.
- Two, as a result of it being a process, it is about creating an atmosphere for learning and social engagement in which participants and stakeholders endeavour to improve the existing situation, for today and for tomorrow's need. This is noteworthy as we can only know the needs, values, and aspirations of people through engagement with them.
- Three, one of the core objectives of sustainability is to ensure harmony and balance between conflicting aspirations and reducing the scope for adverse trade-offs. This is essential and central to decision-making to decide which options contribute best to sustainability in that context.

- Four, a recognition of both inviolable limits and opportunities for creative innovation.

However, as the campaign for sustainability continues to intensify, the roles of urban areas have increasingly been recognised as the suitable arena to address sustainability challenges. The next sub-section examines this position and the related concepts to urban sustainability.

2.2 Overview of Urban Sustainability

With more than 50 per cent of the global population now residing in cities (Sodiq et al., 2019; UNDESA, 2019), it has been argued that the battle for sustainability will be won or lost in cities (Madu et al., 2017; Gehl, 2010). This is because most of man's activities now occur in cities which are accompanied by key environmental, social, and economic challenges. As a result, how to keep urban areas sustainable despite these developments has gradually become a critical agenda of society development, while also taking a central position in both science and policy arena (Orazlin and Mahmood, 2018). For example, at the international level, the Sustainable Development Goal (SDG) 11 is aimed at delivering sustainable communities (UN, 2015), while the New Urban Agenda, and the New Urban Sustainability Frameworks by the World Bank are to help to shape and deliver sustainable urban places.

Urban sustainability has been defined using the approaches to sustainability discussed earlier as either a state or a process. From the ecological perspective, Adinyira et al. (2007) posited that it is a desirable state of urban conditions that persist over time within the earth's carrying capacities and without imposing demands that are not sustainable on the local and global resources. Peng et al. (2011) supporting this position argued that the continued existence of natural ecosystems is important as a measure to assess the success of regional sustainable development. However, this position raises a question of the concern for man's wellbeing and social enhancement as advocated by the pioneers of sustainability discuss.

To this end, Dempsey et al. (2011), Wu (2010), Smith (2015), Elmqvist et al. (2013), and Nassauer et al. (2014) argued that the concept of urban sustainability goes beyond environmental issues, but also involves enhancing synergy between ecosystem services and human wellbeing. In simple terms, urban sustainability involves creating an environment that satisfies needs while avoiding unacceptable social and environmental impacts (Zhao, 2011; Hamilton et al., 2002; Wu, 2014; Wheeler, 2004; Sharifi, 2016).

It is important to submit here, that in order to stress the importance of the social, economic, and environmental aspects of urban sustainability, several scholars have addressed them separately. Santos and Martins (2007) submitted that the ability of cities to enable city dwellers proposer economically is known urban economic sustainability; while its potential to function as a long-term viable setting allowing human interaction, participation, communication, and cultural and social development is defined as urban social sustainability (Shafer et al., 2000). Krekel et al. (2016) and Weziak-Bialowolska (2016) defined urban environmental sustainability as a state whereby a city's natural capital is maintained and integrated into the city's daily life.

In addition to the dimensions of urban sustainability, are the three main components of quality, flows, and patterns which can be used to assess the progress of urban areas (Alberti, 1996). Although, urban areas have the shared physical characteristics of abundant built-up structures, high population density, extensive impervious surfaces, air pollution, and modified ecosystem functions and services among others (Grimm et al., 2008; Pickett et al., 2013; Newmann and Jenning, 2008), the three components vary from one context to another. For instance, the quality of an urban area is a function of its physical elements, socioeconomic conditions as well as its culture and values. The urban flow which has been conceptualised through various approaches such as the ecological footprint which is unique to an urban area assess its impact on the environment by reviewing the distribution of natural resources that support activities. Also, how an urban area functions in terms of its spatial structure and organisation known as its pattern is peculiar to that context.

The above submissions suggest the need to holistically address the economic, social, and environmental aspects in the planning phase of new development. It also raises the question of how these can be integrated and prioritised in the decision-making process. Indicators have been useful to address this is later examined in section 2.7.

2.3 Related Concepts to Urban Sustainability

As the campaign for urban sustainability continues, three different but interrelated concepts of smart growth, new urbanism, and eco-city have emerged in various contexts as argued to be directly associated with urban sustainability (Jepson and Edwards, 2010). These three concepts according to their proponents have the potential to deliver sustainability by virtue of their characteristics and principles. The section explores the extent these concepts can promote urban sustainability and their limitations. This is because they are already being applied at various scales of spatial development with an attempt to address sustainability. For example, there is evidence in literature of smart building (Liu et al., 2018; Carr et al., 2017); smart city (Ismagilova et al., 2019; Caragilu and Del Bo, 2019); smart neighbourhood (Fernandez et al., 2018); Eco-districts (Weber and Reardon, 2015; Flurin, 2017); and Eco-city (Li et al., 2019) amongst others. In addition, to explore the characteristics of the indicator set of a NSAF, it is important to know the extent to which the indicator set promote each of the concepts at the neighbourhood level.

2.3.1 New Urbanism

New urbanism emerged in the United States (US) as an international response to Post-World War II suburban sprawl triggered by the rise in automobile (Wey and Hsu, 2014; Garde, 2006; Duany and Brain, 2005; Talen, 2005). Traceable to the ‘neo-traditional urbanism’ pioneered by Calthorpe, Duany, and Plater-Zyberk in the 1980s, it emerged as an alternative approach to the dominating patterns of low-density, and auto-dependent land development (Ellis, 2002). The pioneers of this concept, and several scholars argued that it is a model whose planning principles can deliver urban sustainability (CNU, 2016; Wey and Hsu, 2014) because it addresses both environmental and social problems linked with living in cities based on the following characteristics.

One, an advocate that land development should be guided by an interest to deliver places that both minimise the environmental impact of development. Two, aimed at delivering pedestrian-oriented settlements through the internal circulation of spaces (Stanislav and Chin, 2019), while also promoting social equity and sense of community amongst residents (Trudeau, 2013). Three, as a design concept, it focuses on the physical appearance of places with a concern to improve the quality of life (Wheeler, 2004, 2013). Four, new urbanism seeks to emphasise and operationalise the relationship between the art of building and place-making through citizen-based participatory planning and design (Godschalk, 2004).

Continued discussion and collaboration amongst the pioneers of this concept heralded the Charter of the New Urbanism (CNU) in 1993 with a set of foundational principles to guide development at the following three scales of spatial development: (i) region, metropolis, city, and town; (ii) neighbourhood, district, and corridor; and (iii) block, street, and building. The principles suggest a peculiar urban design theory with a set of goals that new urbanism development should achieve (Trudeau, 2013).

A review of the principles reflects an interest in urban sustainability as concerns for enhancing social equity and reducing the environmental impacts of settlements were re-echoed across the various scales of spatial planning (White and Ellis, 2007). For example, the Charter states that the physical organisation of a district should be supported by a framework of diverse transportation means. In addition to this, transit, pedestrian, and bicycle systems should maximise mobility in the region while reducing dependence upon the automobile. For neighbourhoods, they should be compact, pedestrian-friendly, and mixed-use while streets should be designed to encourage walking. At the block, street, and building scale, it is expected that architecture and landscape design should grow from the local climate, topography, history, and building practice.

However, the extent new urbanism contributes to urban sustainability has been questioned. Although the proponents argued that it can enhance sustainable behaviour, the actualisation of this depends on demographic diversity. For example, social interaction only thrives in a socially homogenous settlement. This can be affiliation by race, or socio-economic group amongst others. Other critiques of the new urbanism as it relates to urban sustainability include: One, it is characterised of decentralised developments with less commitment to environmental sustainability (Crew and Forsyth, 2011). That is, its design and planning do not encourage the reduction of ecological footprint or environmental impact of development as envisaged. Two, increased density leads to delivery of settlements that are not environment-friendly in terms of aeration, waste control and management, and sanitation among others (Berke et al., 2003). Three, most new urbanism projects are not located in urban areas, but in suburbs thereby defeating the purpose of addressing land use and development patterns characterised of large urban areas and megacities (Beatly and Manny, 1997).

2.3.2 Smart Growth

This is an urban concept which advocates that development and growth should be concentrated in compact walkable urban centres to prevent sprawl through better land use and transportation planning (Boeing et al., 2014; Miller and Hoel, 2002). As a dominant alternative approach to address suburban sprawl in urban planning in North America (Bohl, 2000), the terms ‘compact city’ and ‘urban densification' have been used to describe the concept in Europe. Although smart growth shares some similarities with the new urbanism, there are few differences. One, while the new urbanism is traceable to the earlier works of architects and physical planners, the smart growth concept emerged through the collaboration of a community of environmentalists, citizens’ group, transportation planners, and policymakers (Geller, 2003). Two, new urbanism focuses on function and ethics of the construction environment, but smart growth focuses more on planning and decision-making.

Smart growth has been conceptualised by various stakeholders based on their peculiar aspirations and needs (Miller and Hoel, 2002). While it is defined by environmental groups in terms of air, and water quality; open space protection; resource preservation; and environmental justice among others; urban planners see it in terms of its cost savings and providing infrastructures to common good of the people with a wide range of different housing choices, and its potential for regeneration (Goldschalk, 2004). As a concept, smart growth attempts to resolve urban issues through science and technology (Angelidou, 2017).

However, the Smart Growth Network under the United States Environmental Protection Agency (US EPA) identified the following 10 basic principles which according to Wey and Hsu (2014) has been widely accepted to guide smart growth strategies in various contexts: (i) mixed land uses; (ii) compact building design; (iii) a range of housing opportunities and choices; (iv) walkable neighbourhoods; (v) distinctive, attractive communities with a strong sense of place; (vi) preserve open space, farmland, natural beauty, and critical environmental areas; (vii) strengthen and direct development towards existing communities; (viii) variety of transportation choices; (ix) make development decisions predictable, fair, and cost-effective; (x) encourage community and stakeholder collaboration in development decisions (EPA, 2018).

The above submission suggests that the smart growth concept adheres to some of the principles of sustainability in terms of meeting needs and delivering settlements that deliver social equity. However, how this could strongly promote environmental sustainability is an area that needs to be explored. This is because, only one of the ten principles addresses environmental concerns.

2.3.3 Eco-Urbanism

Eco-urbanism as a concept aims to develop urban places that do not exceed the limits of nature to sustain them (Li et al., 2005; Jepson et al., 2010; Tsolakis and Anthoupoulus, 2015; and White, 2002). It is the development of multi-dimensional sustainable human communities with harmonious and balanced built environments (Ruano, 1998). This according to the proponents could be achieved through public policies that advocates for renewable energy sources, biodiversity preservation and conservation, and waste control and management. As a concept that emerged in the early 1980s, it attempts to integrate sustainability aspects and principles of smart growth, and new urbanism while addressing the challenges posed by climate change and resource constraint (Joss et al., 2013).

However, a distinguishing feature of the eco-urbanism is the adoption of green technologies such as smart grid, net-zero buildings, solar technology, and water treatment systems among others (Joss and Molella, 2013; Yigitcanlar and Lee, 2014). Other features of eco-urbanism include: One, a minimal ecological footprint which promotes living in harmony with nature (Pow and Neo, 2015; Yu, 2014). Two, self-contained communities with strategies for economic stability (Pow and Neo, 2015). Three, it serves as a testing lab for small scale technologies which can be rolled out on a large scale after an appreciable degree of success (Premalatha et al., 2013; Cugurullo, 2013).

To this end, in terms of environmental sustainability, the eco-urbanism concept has the edge over the new urbanism and smart growth concepts because most of its projects are developed on brownfield sites (Sharifi, 2016). This helps to protect and preserve valuable natural features that provide the urban populace with the required eco-system services for survival. Eco-urbanism has continued to be practised globally due to its wide acceptance. This is unlike other concepts which are peculiar to North America or few European countries (Joss et al., 2013). This has therefore facilitated the knowledge-transfer of this concept. For instance, there are over 200 eco-city projects in China (Pow and Neo, 2015). South Korea, Japan, France, Indonesia, and United Arab Emirate (UAE) also have few demonstration projects (Cugurullo, 2013; Datta, 2012). There is however limited evidence of its implementation in Africa, Latin America, and Australia (Joss et al., 2013).

However, the potential of eco-urbanism to deliver sustainable urban places has been questioned due to the following criticisms. One, it has less consideration for social sustainability aspects such as inclusiveness, and sense of belonging (Cugurullo, 2013). For example, eco-cities in England and India are characterised with the shortcomings of not providing a balanced consideration of sustainability issues (Warwick, 2015; Datta, 2012). Two, as characterised of other concepts, eco-urbanism relies on physical design and technological innovations, thereby undermining the key role that can be played by the public and relevant stakeholders in driving social change (Joss and Molella, 2013). As a result, most eco-urbanism projects have not been able to meet the targets set of the outset of the project as some require behavioural change. Three, most eco-urbanism projects have limited impact in contributing to the neighbouring environments which calls for a concerted effort across all scale of spatial development (Tomozeiu and Joss, 2014).

2.3.4 Reflection on Related Concepts

Having reviewed some related concepts to urban sustainability with their applications, advantages, and shortcomings, it can be deduced that they have shared characteristics (figure 2.3). For example, new urbanism and smart growth have the key features of compact and mixed-use, social equity and sense of community, encouragement of diverse transportation, and citizen-based participatory planning. However, since a neighbourhood that prides itself in either new urbanism or smart growth cannot deliver sustainability, this calls for the integration of the key principles that define these concepts as illustrated in figure 2.3, and other aspects that are not covered by any of them which perhaps may be context-specific in the vision for urban sustainability. This has been adopted by some NSAFs which by their indicator set, advocate for new urbanism, smart growth, and eco-urbanism at the neighbourhood level (USGBC, 2018; BRE, 2012).

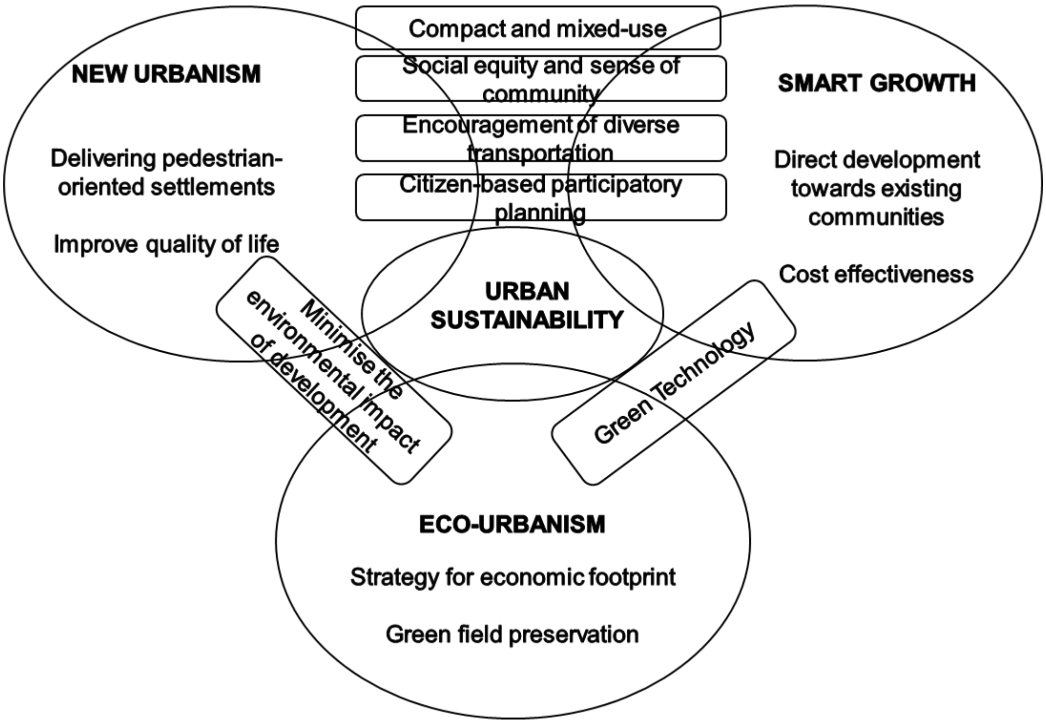

Figure 2. 3: Integration of the related concept of sustainability
Source: Author, 2020

In addition to this, these principles are already further being tested and operationalised at the neighbourhood scale (Chastenet, et al., 2016; Paiho et al., 2014; Caprotti, 2014; Joss et al., 2015), a testament to their wide acceptance in planning for sustainability. The next section examines the neighbourhood concept and its crucial role in visioning urban sustainability.

2.4 Neighbourhoods as Building Blocks for Urban Sustainability

In recent times, scholars have argued that the neighbourhood has a significant implication for urban sustainability (Dawodu et al., 2017; Ferwati et al., 2019; Moroke et al., 2019). This is premised on the following understandings. One, that the neighbourhoods are the building blocks for urban areas (Wangel et al., 2016) and as a result, urban sustainability will be unattainable if the component parts are themselves unsustainable (Choguill, 2008). Corroborating this view, Stanislav and Chin (2019) and Barton et al. (2010) submit that the overall quality of an urban area is determined by the quality of its neighbourhoods. Two, the neighbourhood offers an appropriate platform to access the socio-economic impacts of developments, while also facilitating citizens' involvement in planning and decision-making (Moroke et al., 2019; Sharifi, 2013). These positions underpin the concept and approach of neighbourhoods as a unit of scale and function that could be used as a building block for planning sustainable urban places. Therefore, such an understanding can be used to think about and plan for the wider urban area.

This section is divided into three. The first examines the various paradigms through which a neighbourhood as a scale of planning can be understood; the second presents its evolution and implication for planning; the third section investigates the concept of sustainable neighbourhood and its dimensions.

2.4.1 The Neighbourhood Scale

Although the term 'neighbourhood' has been used for a long time (Choguill, 2008), it has no single agreed definition (Kearns and Parkinson, 2001; Galster, 2001; Rohe, 2009). For instance, stakeholders are most times confronted with the challenge of determining whether it is a street of 100 people, or a ward of 10000 inhabitants. However, the neighbourhood scale of spatial development can be understood and defined using Lefebvrian triadic conception and production of the urban space elaborated by Salama and Wiedmann (2013) and Salama (2019a) as illustrated in figure 2.4.

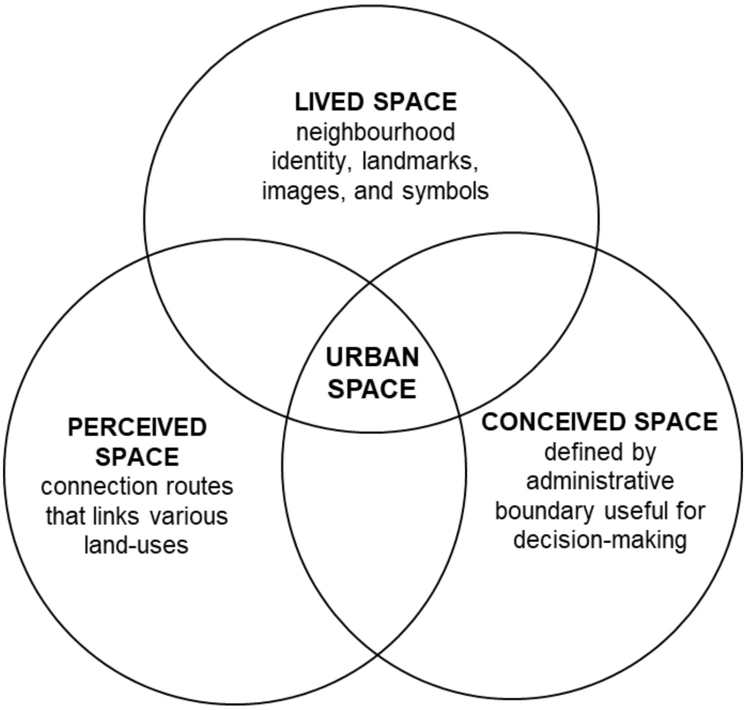

Figure 2. 4: Perception of the neighbourhood scale using the Lefebvrian triadic conception of space
Source: Author, 2020

One is the "conceived space" which in this instance would peceive a neighbourhood as defined by the intellectual capacities of planners, engineers, and other built environment professionals. It is the way and manner that decision-makers define the neighbourhood which is to serve as a basis and a guide in making decisions. This understanding supports Young Foundation (2010) that perceived the neighbourhood scale from the administrative boundary. That is, based on the administrative structure of the area or authority. In some instances, an electoral ward, or part of it may be referred to as a neighbourhood. The administrative structure may also highlight key parameters that define a neighbourhood in a particular context.

Two is the "perceived space" which is where movement and interaction takes place, where networks are developed and materialised (Salama, 2019a). It explains the aspect of the neighbourhood that links places for work, leisure, and private.

Lastly is the "lived space" which has to do with the public realm which is associated with images and symbols. They can be understood as the non-verbal relationship of human to space which are essentially subjective. This seems to be the most dominant understanding from a non-expert perspective. In this instance, a neighbourhood is defined by a variety of building uses and human activity with several places to go within walking distance. It is characterised with tree-lined streets, sidewalks, playgrounds, and parks, among others which are unique to the area.

These perspectives of the neighbourhood have indirectly shaped the various definitions it has attracted. For instance, based on the conceived space ideology, it is "*a place with specific physical boundaries*" (Keller, 1968:89; Golab, 1982). A neighbourhood as a perceived space is the immediate social and physical environment around the dwelling unit (Berk, 2010). It is an area with "*a limited territory within a larger urban area, where people inhabit dwellings and interact socially*" (Hallman 1984:13). Drawing from both the conceived, perceived, and lived space perspectives, Wheeler (2013) and Bianca (2000) defined a neighbourhood as an area that can be traversed by foot with some distinct and unifying social, architectural, historical, and economic features. It is a residential area with a radius of about 400 to 600m (Urban Task Force, 1999), of distinctive identity, often distinguished by name and bounded by recognisable barriers or transition areas such as railway lines, main roads, parks, and the age or character of buildings" (Barton et al., 2010).

Whilst these definitions identified the distinctive character of a neighbourhood in terms of its spatial and administrative extents, including social interrelationships, a detailed definition was given by Galster (2001:2112) who conceived the neighbourhood as "the bundle of spatially based attributes associated with clusters of residences, sometimes in conjunction with other land uses". These attributes include:

(i) Structural characteristics of building type e.g. type; materials; and design
(ii) Infrastructural characteristics e.g. roads; sidewalks; and utility services
(iii) Demographic e.g. age patterns; family composition; and religious types
(iv) Sentimental characteristics e.g. residents' sense of identification with place
(v) Class status e.g. income groups; occupation; and education composition

(vi) Public service package e.g. public schools; administration; recreation etc.
(vii) Environmental characteristics e.g. extent of land, air, water, and noise pollution
(viii) Proximity characteristics e.g. nearness to major destinations
(ix) Political characteristics e.g. local political networks
(x) Social interactive characteristics e.g. local friend and kin networks

These attributes help in the understanding of a neighbourhood, and most importantly its characteristics which may be different from what is obtainable in another context. For example, the demographic distribution gives information about the diversity of the neighbourhood in terms of age pattern, family composition, ethnic background, and religious inclination which may perhaps be useful in planning.

2.4.2 Planning at the Neighbourhood Scale and its Implications

Historically, planning at the neighbourhood level is not new because it is traceable to the works of pioneer urban Planners with each one having an influence on planning at this scale of spatial development. For instance, the Garden City transformed the profession of urban planning from public health exercise which it has been known for, to that which now considers the relationship and spatial arrangement of urban activities. Developed by Ebenezer Howard - a British urban Planner in the closing decades of the nineteenth century, it was a mix of the best of the city and the countryside. The Garden City attempted to establish connections between the dwelling unit, the neighbourhood, the ward, and the town in relation to other places (Farr, 2008).

The Neighbourhood Unit which later emerged advocated for a safe and walkable neighbourhood by providing the specific guidelines for how residences, community services, streets and businesses should be spatially distributed. For example, in the neighbourhood unit, there is a separation of vehicular and pedestrian traffic. Developed by an American- Clarence Perry, the Neighbourhood Unit was to serve as a framework for urban Planners attempting to design functional, self-contained and desirable neighbourhoods in the early twentieth century in industrialising cities (Perry, 1929). The concept also tends to promote neighbourhood meetings and activities using the elementary school located in the centre of the neighbourhood (Choguill, 2008).

The Radburn concept as another approach to planning at the neighbourhood level developed in 1929 by Clarence Stein and Henry Wright was characterised of a superblock and a cul-de-sac, which canvassed for a neighbourhood with a pedestrian path that does not cross any major roads. This is to encourage interaction among residents with the integration of modern planning principles

A major implication of these concepts is that they have continued to shape how neighbourhoods are planned in various parts of the world. For instance, the Garden city has been replicated in other parts of the United Kingdom (UK) where it originated, while also influencing developments in North America, Australia and New Zealand, Europe, Asia and Africa. The Radburn concept has also been applied in some parts of Canada, Australia, and the UK. This wide acceptability across various location leads to a question as to how they contribute to and enhance the principles of sustainability at the neighbourhood level.

2.4.3 Conceptualising a Sustainable Neighbourhood and its Dimensions

A sustainable neighbourhood has been defined by scholars from the two main perspectives of liveability (Bahadure and Kotharkar, 2019), and intergenerational and intragenerational equities (Urban Task Force, 1999); linking the spatial and the human wellbeing or welfare dimensions. In terms of liveability, it is a place "*where people want to live, work, prosper and enjoy a good quality of life, now and in the future*" (Roberts, 2009:128). It can be compact, pedestrian-friendly and mixed-use in which daily living activities can be carried out within the shortest possible distance, through interconnected networks of streets (CNU, 2016). From the perspective of intergenerational and intragenerational equities, a neighbourhood is considered sustainable if it meets the diverse needs of both existing and future residents, irrespective of social class or group, by contributing to high quality of life with opportunities and choices where all activities are executed within the earth's carrying capacity (Office of the Deputy Prime Minister ODPM, 2004). This perspective takes the definition of a sustainable neighbourhood beyond human needs, but also emphasises the spatial and temporal interdependencies of all developments or activities as constrained within environmental limits.

Nevertheless, Edwards (2014), UN-Habitat (2015b), Barton et al. (2010), and Blum and Grant (2006) identified six components of a sustainable neighbourhood which were re-echoed in the sustainable urban neighbourhood (SUN) design model that emerged in the UK in the 1990s by Urban and Economic Development Group (Rudlin and Falk, 1999).

One is connectivity which aims to ensure good physical (spatial) and social relations within the neighbourhood, and with existing neighbourhoods (Barton et al., 2010). The enabling environment for connectivity ideally can be enhanced through adequate levels of a street network that does not only accommodates vehicles and public transport, but also specifically encourage pedestrians and cyclists. This is also essential, because it is the street network that dictates the pattern of development blocks, streets, buildings, open spaces, and landscape.

Two is high housing density which has the potential of preventing urban sprawl and promote sustainable growth (Jabereen, 2006). A neighbourhood with a high density makes public transport a more realistic and viable option for movement, thereby lowering the energy uses for transport purposes and associated air pollution (Newman and Kenworthy, 1989; Newman and Kenworthy, 1998). Edwards (2014) recommends 200 persons (40-50 dwellings) per hectare and at least 2 land uses per hectare (e.g. housing and shopping). High housing density also enhances economic prosperity because the economic viability of facilities is increased if they are within walking distance to consumers.

Three is diversity which is a principle that advocates for a balanced neighbourhood driven by social inclusion and characterised by various housing types, different types of indigenous work, diverse modes of movement, and various aesthetic characters (Blum and Grant, 2006). Diversity also addresses the ease of movement of people and not cars by diverse options which adds to the urban character (Rudlin and Falk, 1999; Sharifi and Murayama, 2013; Sharifi and Murayama, 2015). The neighbourhood should also be designed to accommodate and enhance local autonomy. This means that infrastructure and necessary services need to be readily available within the neighbourhood at the shortest possible distance. Local facilities, employment, community network should be managed within the locality. This would reduce pollution and abate the need for the importation of energy, water, and other materials.

Four is stakeholders' involvement which advocates that all parties that affect or will be affected by a new development are engaged and are well represented in the decision-making process. The idea behind this is that the successes or shortcomings of such project or development depend largely on the input from the respective stakeholders. Stakeholders' engagement in planning for sustainability and its assessment is discussed extensively in section 2.7.6.

Five is adaptability which suggests that neighbourhoods should be able to adjust to new conditions, as it gradually reaches the projected population that it is designed to accommodate. In other words, it should be resilient to associated pressure as a result of man's activities and natural changes in the environment. This can be achieved by designing buildings for various uses, maintenance of infrastructure, keeping transport options open; and adaptable building forms.

Six is greenfield preservation and biodiversity conservation which advocates for the reuse of brownfields sites for new developments, because most brownfield sites are normally endowed with basic living infrastructures such as electricity, water, sewerage, and public transportation among others. Choice of these sites reduces the pressure on reserved (green belt) land, while also delivering neighbourhoods located close to work, leisure and education (Edwards, 2014).

However, it is noteworthy that some of these components are context-specific and may not deliver sustainable outcomes in all contexts due to different developmental challenges (Moroke et al., 2019). For example, while a compact neighbourhood is highly recommended due to limited land in some contexts, advocating for such principles like densification, the design approach may not be suitable in some locations because of cultural orientation, religious inclination, and technological know-how. This suggests the need to capture stakeholders' perceptions of a sustainable neighbourhood in various contexts in a manner that addresses the above peculiarities as employed for this study.

These 6 components suggest a 3-dimension approach in conceptualising a sustainable neighbourhood which was adopted for this study as illustrated in figure 2.5. These are environmental, economic, and socio-cultural dimensions. This is a modification to the widely used Triple-Bottom-Line (TBL) of environmental, social, and economic dimensions in addressing sustainability (Quan, 2018; Martinez-Bravo et al., 2019; Valcarcel-Aguiar and Murias, 2018; de Jong et al., 2015; Opon and Henry, 2019). Although, there has been a call for the institutional dimension, covering such issues like stakeholder engagement and inclusion. These are discussed in this study under the social-cultural dimension.

The three dimensions are what should guide development and decision-making at the neighbourhood level based on the institutional framework and requirements. As a result, the relationships between these dimensions known as the urban metabolism need to be well understood in planning for urban sustainability (Chrysoulakis et al., 2015). Elaborating this, the Science for Environment Policy (2015) submitted that the integration of the social and the environmental dimensions leads to a liveable world; economic and social dimensions results to a fair world; while economic and environmental dimensions integration leads to a viable world; but only the integration of the three dimensions results to sustainability (figure 2.5).

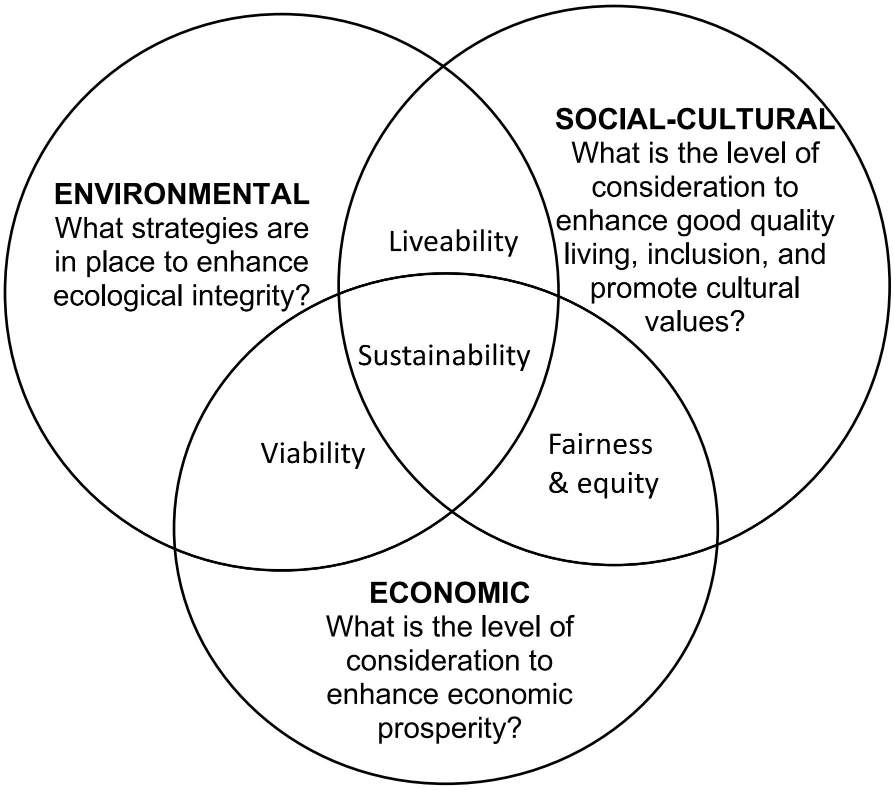

Figure 2. 5: Dimensions of a sustainable neighbourhood
Source:Science for Environment Policy, 2015

Environmental

Environmental dimension captures the impact of man's behaviour on the bio-physical world addressing concepts like land use, transportation. It is concerned with how the built environment can help reduce the associated negative implication of man's use of environmental resources to enhance the quality of water, air, and habitats upon which life depends (White and Ellis, 2007). This dimension advocates that for a neighbourhood to be considered sustainable, its development and operation should not in any way affect ecological integrity (Kennedy et al., 2007). That is, the earth's carrying capacity should not be altered. For example, after its design and prior to construction, an impact assessment will be useful to assess the impact such development would have on the environment (UN-Habitat, 2012). Also, how resources such as water, material, and energy would be used efficiently without waste must be given consideration due to the continuous scarcity (Oduwaye, 2009; Gibberd, 2015). In addition to waste reduction, it also addresses waste management, which if not handled properly could have an adverse effect on the environment (Ibem and Azuh, 2011; Ilesanmi, 2010b;

Ezirim, 2005; Adejobi and Olorunnimbe, 2012; Gibberd, 2015). It raises the question of whether a central sewage system would be ideal, or would there be facilities for waste recycling and re-use? Prior to the operation of the neighbourhood, how will its wastes be effectively managed during construction without affecting the nearby neighbourhoods? Another aspect that the environmental dimension considers is the use of renewable energy systems which produces clean energy, and at the same time reduces greenhouse gas emissions (Ilesanmi, 2010b; Ezirim, 2005).

Furthermore, the environmental dimension recommends that the planning and design of a new neighbourhood ideally should not lead to deforestation or alteration of the natural habitat. As much as possible, at the site selection phase, green fields should be preserved while brownfields should be remediated for re-use (BRE, 2012; USGBC, 2018). Consequently, while the neighbourhood should be spacious, the proposed site should be used efficiently by clearly defining functions of spaces. In some parts of the world, concepts such as densification are used to address this (Emza and Oluwatayo, 2014; Ezirim, 2005). Also, for longevity and continued function of amenities and infrastructures such as drainage, there should be a deliberate and strategic plan for maintenance (Ilesanmi, 2010b). Furthermore, as the built environment is associated with pollution (e.g. air, water, noise etc.), adequate measures should be put in place in the planning, design, construction, and operational phases of the neighbourhood to reduce this to the minimum (Adedeji et al., 2010).

Socio-cultural

The socio-cultural dimension of sustainability advocates for a neighbourhood that enhances good quality living, inclusion, and promotes cultural values. This dimension argues for three main positions: One is that development is not only socially mediated, but also has societal implications which are essential to evolve workable strategies to achieve both environmental sustainability and economic growth (Trudeau, 2013). Two is the need for social equity where there is equitable access to services, jobs, transportation, and housing which are essential for sustainability (Vallance et al., 2011). Three is that there are certain social requirements such as social interaction within a place, and neighbourhood pride which are important in defining a place where people want to live (Bramley and Power, 2009; Dempsey et al., 2011). This forms one of the integral frameworks because it refers to how the neighbourhood can enhance the quality of life, now and in the future (Ibem and Aduwo, 2015a).

To enhance wellbeing of residents, the neighbourhood at its planning and design stage needs to integrate: (i) facilities that enhances social interaction and conviviality such as parks, gardens, and recreational spaces among others (Fadamiro, 2000; Ilesanmi, 2010b; Akingbohungbe, 2005); and (ii) aesthetics which contributes to the residents' experience as an aspect of the socio-cultural dimension (Ibem and Amole, 2010; Adedeji et al., 2010). This may be achieved using public arts and landscape elements such as hedges, shrubs, and garden chairs.

In addition, the neighbourhood should be designed to encourage walking by creating a friendly pedestrian lane (Akingbohungbe, 2005; Ezirim, 2005). This does not only promote healthy living of residents, but also has the potential to reduce the use of cars for short distances thereby reducing air pollution from automobiles. Furthermore, other environment-friendly mobility options like cycling should be considered. This socio-cultural dimension also canvases for community engagement in the planning phase of the neighbourhood amongst the stakeholders that would be involved. Besides this, the neighbourhood design should reflect the consideration for certain users such as old people, the physically challenged, and toddlers in terms of their accessibility to infrastructure and amenities (Fadamiro, 2000).

What is also very important is the availability of social amenities and infrastructures (Oduwaye, 2009; UN-Habitat, 2012) which enhances the habitability of a neighbourhood. Ideally, they should not be provided after some years of occupancy, but at the time when the neighbourhood is commissioned and delivered to the public. Social amenities include basic health centre, schools, banks, and sporting facilities among others while infrastructure includes drainage, road, telecommunication network, bus stops and street light among others. It is however not enough to provide social amenities but ideally, they should also be centrally located, where they can easily be reached by residents within walkable distance (Ibem and Amole, 2010).

In addition, planning and design measures to secure human lives and properties must be considered. Concepts such as secured-by-design should be adopted (Gibberd, 2015) besides the presence of a police station in the neighbourhood as a threat and proactive measure to crime. Also, amenities that could lead to disasters such as petrol or gas stations should be well-thought-out and be strategically located possibly zoned off from the residential areas.

Cultural consideration for a sustainable neighbourhood should reflect the cultural values and aspiration of the residents (Ibem and Azuh, 2011). Odebiyi (2010) posited that the important role that culture plays in sustainability cannot be overemphasized. Urban sustainability challenges need to be addressed through strategies which are adaptive and takes into consideration the socio-economic and cultural characteristics of the population (Olujimi, 2009). As rightly put in the Africa context, poverty is traceable to the inability to explore the high sophisticated knowledge inherent in her people and local communities, knowing well that this is the cornerstone of every development (Viriri, 2009). UN (2009) suggests that Africa's multi-diversified cultural values could be helpful in promoting development initiatives. While it is not unimportant to learn from foreign cultural values, Odebiyi (2010:26) posited that "*it is necessary that Africa enhances its traditional systems to promote technological progeny and not a total jettison of its viable and sustainable values rooted in its culture*". Therefore, this calls for a hybrid of the traditional approach and contemporary practices.

Besides the capture of indigenous knowledge, scholars have argued that SSA has a diversified but a unique cultural and building practices that share similar characteristics with sustainable or green architecture (Du Plessis, 2005). This is because Africa indigenous architecture agrees with the sustainability requirements of the utilisation of environmental resources and its conservation. While indigenous architecture has been widely known to focus on building climatology as characterised of its responsiveness to the tropical climate, there is a need to explore how it could also enhance the delivery of affordable homes. To this end, the re-integration of indigenous and vernacular values to neighbourhood development could contribute to cost-effectiveness, energy efficiency, and the availability of local resources. For example, as building materials account for the greatest percentage of construction cost, the use of locally available materials would help to reduce this.

Economic

The economic dimension of sustainability advocates for a neighbourhood that enhances economic growth and empowerment. This can be achieved in the following ways. One, the neighbourhood must be designed to support local or home-based businesses (BRE, 2012) by providing the enabling environment in terms of adequate retail outlets with supporting infrastructures like electricity for the businesses to thrive. This position agrees with the performance-based planning concept that advocates for mixed-used planning against the traditional zoning arrangement where a layout or neighbourhood is purely residential with less commercial activity to support the living of the residents. Two, at the planning and the design stages, the affordability of the neighbourhood to the end-users should be considered as advocated recently by various scholars (Ibem, 2011; Ibem and Azuh, 2011; Oduwaye, 2010; Ilesanmi, 2010b).

One of the ways to achieve this is that, it should have various design options to accommodate various income groups. Besides, there could be a mix to accommodate different family sizes. It addresses both intragenerational and intergenerational equities, meeting the housing needs of both present and future generations respectively. Three, how the finished product will get to the end-user should also be clear at the planning and design phase. That is, what ownership options would be available to ensure that the neighbourhood is affordable to all? Is it outright purchase, on a rental basis or mortgage?

This is to accommodate the various social classes. Another aspect of the economic dimension which needs to be considered is the cost and ease of maintaining the proposed neighbourhood (UN-Habitat, 2011; Ibem, 2011; Gibberd, 2015). Ideally, it should not be expensive to maintain so that huge resources will not be put to that.

The review of the various aspects and dimensions of sustainability at the neighbourhood level leads to a decision-making problem of how they can be integrated and put into consideration in the planning of new development without compromising one another. This is to ensure that neighbourhoods delivered are perhaps environment-friendly, socially inclusive, and economic-viable. Besides, the dimensions would also help in exploring the characteristics of the indicator set of a NSAF in terms of under which dimension or dimensions can the indicator be explained. The next section examines the decision-making theory and its relationship in neighbourhood planning to deliver urban sustainability.

2.5 Decision-making for Urban Sustainability at Neighbourhood Scale

Decision-making is "*a process involving activities that starts with the recognition of a decision-making problem and ends with a recommendation for a decision*" (Peldschus et al., 2010:24). According to Peterson and Bomberg (1999), decisions are choices of solution that reduces the uncertainty of action. It most times involves a cognitive process which results in a selection of a preferred option after weighing and considering several alternatives (Wang and Ruhe, 2007). Besides enhancing selection, it also helps in prioritising variables in order of importance. This sub-section reviews the decision-making challenges in planning for urban sustainability and the paradigm adopted for the study after examining various decision-making models.

2.5.1 Challenges of Decision-making

In urban sustainability, there are varieties of decision-making problems (Brandon and Lombardi, 2011) most especially at the neighbourhood level. Some of the problems are: One, how can it be ensured that all sustainability aspects and factors are considered and integrated into planning decisions? Two, how do we prioritise each sustainability dimensions in planning for a sustainable neighbourhood especially when there is a conflicting interest or limited financial resources? Three, what trade-offs are permissible and what synergies can be explored? Four, how do we know whether a proposed neighbourhood is sustainable or not given its various dimensions and aspects? (Quan, 2019; Stigt, 2019).

The problem associated with decision-making for urban sustainability originates from the understanding that the various phases of a new development which are its decision-making windows have the potential of affecting the existing physical, social, cultural, and economic structure. This is because, failure to integrate sustainability aspects in any of the phases in a comprehensive and holistic manner may affect the overall sustainability of the proposed development. The decision-making windows are "*moments in the decision-making process where critical choices are made, which have an environmental implication*" (Jiliberto, 2004:45). They are "*moments in an intricate web of substantively connected deliberative processes in which issues are reframed within a deliberative arena and interests may be linked within and across arena*" (Stigt et al., 2013:19).

To this end, a careful process of decision-making is necessary for satisfactory development in a very complex environment (Boyko et al., 2006; Sheate et al., 2003). Also, this has the potential to deliver neighbourhoods that are sustainable and executed within the earth's carrying capacity. Decision-making in planning for urban sustainability therefore suggests that stakeholders involved in decision-making need to think systematically about the sustainability issues and how to integrate them at various decision windows of a proposed development. That is, a decision can be made after the understanding of the priority levels of the various aspects and criteria that contribute to a sustainable neighbourhood leading to an informed decision.

2.5.2 Decision-making Paradigms

Decision-making can be explained from three perspectives as illustrated in figure 2.6. First is the normative, which sees decision-making to be based on rationality and a consistent approach by explaining the rational behaviour under various circumstances. Second, is the descriptive which tends to explain how decisions are made in real-world (that is, in practice) which might be different from the normative approach. It is mostly concerned with the bounded way in which decisions are made (Divekar et al., 2012). Third, is prescriptive which is of the view that by removing biases and other limitations in the descriptive, the decision-making process can be improved or enhanced by prescribing methods for making optimal decisions (Jiliberto, 2004).

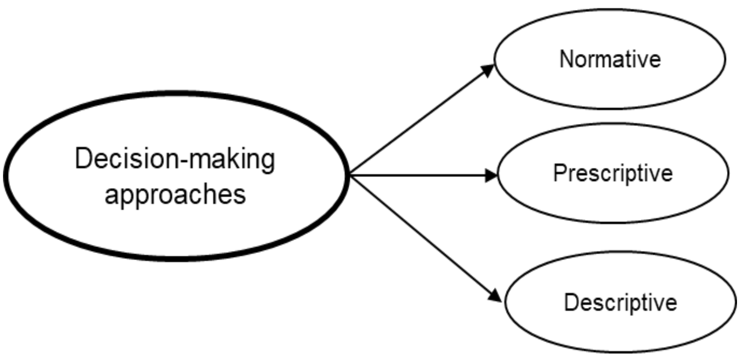

Figure 2. 6: Decision-making approaches
Source: Author, 2020

These three perspectives have been helpful to conceptualise the following models in which decision-making could take place in urban planning. It is noteworthy that the adoption of any of these models has significant implications for decision-making.

One is the bounded rationality which recognises that rationality is limited when decisions are made. While it is not irrational, it has the elements of both the normative and the descriptive perspectives. Traceable to Herbert A. Simon in 1957, the bounded rationality provides an alternative to current norms within the constraints of present challenges. This is because perfectly rational decisions are often not practicable in real-world because of some boundaries. For example, the decision to deliver sustainable urban areas needs to emerge based on adequate consideration of existing boundaries within the context in consideration such as culture, values, needs, and aspiration. That is, rationality does not take the place of these boundaries in the decision-making process. However, it is noteworthy that bounded rationality is not a deviation from the norms (Gigerenzer and Selten, 2002) because it allows the re-thinking of the norms as well as evaluation of actual reality.

Two is incrementalism model first espoused by Lindblom in the mid-1950s, which argues that planning is a muddling through which requires decisions to be made incrementally. The incrementalism which is descriptive argues that the decision-making process is largely reactive to external circumstances and influenced by political consideration (Lindblom, 1959). Therefore, this model tends to focus on short-term conditions rather than long-term decision states.

Three is the mixed scanning model, which emerged because the incrementalism model has been criticised for giving room for the dominance of powerful interests and organized partisans and discouraging basic social innovation. According to Jiliberto (2004), the fundamental decisions set the context for numerous incremental ones. The mixed scanning espoused by Etzioni (1967) is therefore established on the normative assumption that there is a need for structured and rational problem-solving in decision-making while not failing to appreciate the necessity to consider diverse stakeholders' complexity. However, the planning authority still influences the decision from this model since the goal is not necessarily to achieve a consensus among stakeholders on a subject (Etzioni, 1968).

Four is the advocacy model which appreciates the existence of inequalities in the political system and therefore suggests that all various groups should be adequately and equally represented in the decision-making process (Mazzioti, 1982; Davidoff, 1965). As its main characteristics, it encourages a plurality of public interests while recognising the role of the planner as the facilitator with a responsibility of either advocating for the underrepresented groups or encouraging them to be part of the process (Lane, 2005).

Five is the transactive model which is driven by public participation. In this model, public engagement is not considered as an addendum as characterised of the advocacy model, but instead, the public is encouraged to take an active role in the policy-setting process with the institutional stakeholders playing the role of information distributor and a feedback source (ibid). This encourages mutual learning in the sense that the institution gets to know more about the community while the community are introduced and gets to know more about the planning process (Friedman and Miles, 2006).

Six, is the participatory model which although share similarities with both advocacy and transactive models because of the public participation, has a peculiar feature of harmonizing the views of stakeholders to prevent conflicts between opposing groups. This according to Lefevre et al (2000) is part of community development.

2.5.3 Bounded Rationality as a Guide

This study aligns with the bounded rationality theory because in this instance, decision-makers seek to pursue a solution that is practical by appreciating and recognising the crucial role of context in the decision-making process for sustainability (Selten, 2002). For example, decisions about what type of neighbourhood to build have to be made, even though there might not exist empirical knowledge about their potential performances across environmental and social factors. As a result, the decisions will be constrained within what is practical as opposed to what is ideal (figure 2.7).

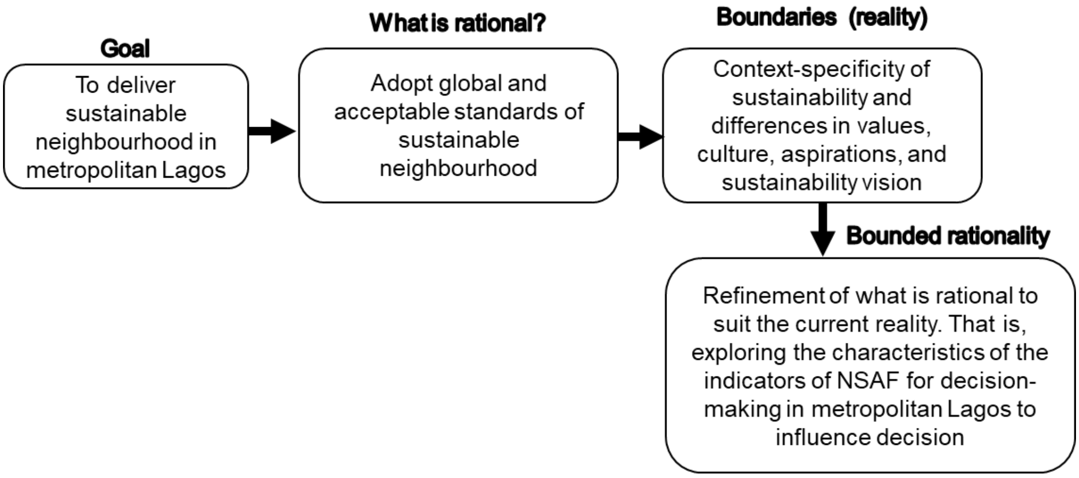

Figure 2. 7: Appropriateness of bounded rationality to study

Source: Author, 2020

The purpose of this study is to deliver a sustainable neighbourhood in metropolitan Lagos by exploring the characteristics of the indicator set of a NSAF. However, what is rational in the decision-making process in planning for the neighbourhood is to adopt the norm or global standards for sustainability as practised in various contexts (e.g. western countries). However, it is important to note the diverse debates on the context-specificity of sustainability which makes the adoption of the rational approach impracticable (without refinement or modification) as a result of the peculiar aspirations, values, and desires of relevant stakeholders in metropolitan Lagos.

Consequently, the bounded rationality suggests the need to explore how context could shape the characteristics of the indicator set which would then be useful in the decision-making process of neighbourhood development in metropolitan Lagos. This by its characteristics, it focuses on what is pragmatic avoiding what might be perfect because it is not practical.

2.6 Neighbourhood Sustainability Assessment as a Decision-making Strategy

Sustainability Assessment (SA) as a concept, process, and method was developed as a decision-making strategy that directs decisions towards sustainability (Hacking and Guthrie, 2008). It is a formal process of identifying, predicting, and evaluating the potential impacts of a wide range of relevant initiatives (such as legislation, regulations, policies, plans, programmes and specific projects) and their alternatives on sustainable development of society (Devuyst, 2000; Hacking and Guthrie, 2008). SA is a distinctive form of Integrated Assessment (IA) which considers the social, economic, and environmental impacts of a proposed development, plans, policies, programmes, and other initiatives (Scrase and Sheate, 2002; Gibson et. al., 2005; Bond and Morrison-Saunders, 2013). It is a type of ex-ante assessment because it is conducted at the preliminary stage of a project to predict future outcomes. This helps to choose between various options. With this, it helps to avoid taking decisions that would not lead to the delivery of sustainable places.

In recent times, SA frameworks have been useful tools and mechanisms to support the decision-making process in planning for urban sustainability, even recently at the neighbourhood scale (Wangel et al., 2016; BRE, 2012;

Green Building Council of Austrialia GBCA, 2012). This it does in three stages. Firstly, by clarifying the definition of sustainability based on the needs, values, and aspiration of the people. The second is by transferring the definition and interpretation of sustainability into an operational information unit in a properly communicated approach using indicators. Thirdly, by implementing the assessment framework to trigger action and solutions based on the simplified and well-communicated information that would enhance urban sustainability (Waas et al., 2014). Executing the first stage which involves exploring the meaning of sustainability to the people implies the appreciation and recognition that the concept of sustainability is context-specific.

Neighbourhood sustainability assessment frameworks (NSAFs) emerged around in the closing decade of the twentieth century (Joss et al., 2015). This was not unconnected to Agenda 21 (a non-binding action plan of the United Nations about sustainable development) which had earlier called for local stakeholders' participation to implement local plans. Coupled to this, was the need to enlarge the scale of SA from the building to the neighbourhood level due to the perceived ineffectiveness of the pioneer Building Environmental Assessment (BEA) tools in assessing the impact of a proposed development holistically (Berardi, 2011; Cole, 1999; Berardi, 2011; Komeily & Srinivasan, 2015). For instance, how can an assessment at the building scale provide information on the sustainability credentials of a neighbourhood? Will it be more worthwhile to take into consideration the host environment in the assessment process? Is assessment at the building scale not a reductionist approach which necessitates the need for a larger-scale system that affords the opportunity to access how a building and its occupants relate with the environment?

NSAF has evolved as a tool to aid decision-making for a better and holistic assessment in monitoring progress toward sustainability. It has been at the front banner in the campaign for urban sustainability (Cashmore & Kornov, 2013; Berardi, 2013). Scholars agree that it has both helped to integrate the various dimensions of sustainability holistically and in the decision-making process by setting out clearly the indicators that must be considered in order of priority when conceptualising a new neighbourhood. Pioneering the movement of NSAF was the development of HQE_2R between 2001 and 2004 and Earthcraft communities in 2003. Subsequently, between 2006 and 2009, the Comparative Assessment System for Built Environment Efficiency for Urban Development (CASBEE-UD), the U.S. Star community Rating System (STAR-CRS), Leadership in Energy and Environmental Design for Neighbourhood Development (LEED–ND), and the UK Building Research Establishment Environmental Assessment Method communities (BREEAM-C) were launched. The German system DGNB New Urban Districts and the Australian system Green Star Communities were released in 2011 and 2012 respectively (Wangel et al, 2016).

However, none of these frameworks is yet to evolve in developing countries. As a result, Yigitcanlar et al. (2015) and Berardi (2013) have canvassed for the definition of criteria for assessing neighbourhoods in developing countries. This raises a question of what would such an assessment framework look like and what characteristics will its indicators have? Also, what role would context play in characterising the indicators?

2.6.1 Classification

There are complexities in classifying NSAFs, which have led to their classification to be based on modes of development and functions. A NSAF can either be third party or plan-embedded in terms of development (Sharifi and Murayama, 2013). It is a third-party if it was developed as an extension of a Building Environmental Assessment (BEA) tool with an enlargement in the scope of its assessment. That is, from the building to the neighbourhood scale. Most of the well-known NSAFs (e.g. BREEAM Communities, CASBEE–UD, and LEED-ND among others) are in this category. It is plan-embedded if it was specifically developed to evaluate proposed plans with respect to their sustainability performance. E.g. Ecocity, HQE2R.

Classifying by function, a NSAF can be in one the following three categories: (i) performance; (ii) certification, and (iii) planning tool kit (Joss et al., 2015). Performance NSAFs measure the sustainability of a neighbourhood development against some criteria in order to make a comparison with another development. Urban areas use performance assessment frameworks to set targets in measuring progress over time which is also useful for policymaking. Examples include: CASBEE for Urban Development/Cities; City Biodiversity Index (Singapore Index); City Grid; Eco-City Development Index System; European Common Indicators; Global City Indicators Facility; Global Urban Indicators; Green City Index; REAP for Local Authorities; Slim City; Sustainable Cities Index.

Certification NSAFs assess a proposed neighbourhood development for the purpose of certification or endorsement which most times involves accreditation process with some fee payment (Joss et al. 2015). In most certification frameworks, the results are classified in order to present them in an understandable manner. The certification also helps to benchmark new developments, and market a proposed development in terms of its sustainability potential (Wangel et al., 2016). Examples include: BREEAM Communities; Climate Positive; Enterprise Green Communities; Green Star Communities; IGBC Green Townships Rating System; LEED ND; Living Building Challenge; Star Community Rating System; DGNB NSQ; One Planet Communities; Sustainable Communities; EcoQuartier; Estidama Pearl Community Rating System; National Eco-County, Eco-City and Eco-Province; National Eco-Garden City; Selo Casa Azul Caisa.

Lastly, the planning tool-kit NSAFs serve the purpose of guiding the processes of planning for sustainability geared towards enhancing a collaborative decision-making process within stakeholders (Joss et al., 2015). They advocate for community engagement and participation in the planning process. Examples include: ASEAN ESC Model Cities; Biosphere Eco-City; Community Capital Tool; Eco Districts; Eco2 Cities; Green Communities; Urban Sustainability Indicators; Charter of Eco Mayors (Les Eco Maires); Eco-Model Cities; Green Climate Cities; and RFSC.

While some NSAFs can perform only one function, some can perform two or three in the decision-making process. For instance, BREEAM Communities which can be categorised under certification assessment frameworks can also be used as a planning tool-kit, encouraging and facilitating community engagement through consultation plan. Furthermore, it can also be used for performance assessment of a regeneration project.

2.6.2 Structure

A NSAF comprises of (i) indicators (ii) weighing system; and (iii) certification level. Table 2.1 shows these components using selected NSAFs as further explained:

Indicators

Sustainability indicators are measurable variables which are used to evaluate a proposed development. There are three significances of indicators in a NSAF. One, since they are locally developed in consultation with stakeholders, they have the potential of stressing the context-specificity of sustainability in an assessment framework. Two, they simplify communication which guides decision-making towards sustainability (Valentin and Spangenberg, 2002). Therefore, this process helps to extend sustainability from abstract formulation to explicit discussions of its concepts and operational meaning that is essential in meeting sustainability targets (Rigby et al., 2001; Rennings and Wiggering, 1997). Three, they serve to actualise the call for greater involvement of the grassroots and local stakeholders because it helps to establish the contextual understandings of sustainability in a simplified way accommodating its social and political ideologies (O'Riordan and Viosey, 1998).

Weighing system

The weighing system gives information about the weight assigned to each indicator which tells its significance in contributing to a decision during the decision-making stages. For instance, the greater the weighting, the higher such indicator is perceived to contribute to a sustainable neighbourhood in that context. This raises a question of how then do we determine the weight of an indicator in a way that will not be controversial and highly subjective? This can be addressed using any of the multi-criteria decision analysis (MCDA) in engagement with stakeholders, which perhaps offers a less subjective scoring and weighing process because the consistency of the result can be determined (Sharifi and Murayama, 2015; Lee et al., 2009).

Examples of MCDA methods include: Analytic Hierarchy Process (AHP); Analytic Network Process (AHP); Preference Ranking Organisation Method for Enrichment of Evaluations (PROMETHEE), involving stakeholders

Certification level

The certification level is obtained after the assessment of the proposed neighbourhood against the indicators. The final score obtained determines the level of certification. This varies from one assessment framework to another. For example, the certification levels in the BREEAM Communities are: outstanding; excellent; very good; good; pass; and unclassified, with each level of certification indicating how well a proposed neighbourhood meets BREEAM sustainability credential. The certification level is conducted in various stages of the proposed development. For instance, the LEED-ND V4 has 3 stages which are: (i) conditional approval; (ii) pre-certification; (iii) full certification.

Table 2. 1: Examples of neighbourhood sustainability assessment frameworks showing their structure

Name	Developer	Vision	Categories and number of criteria		Criteria weighing		Certification levels		Rating stages/ Assessment process	Scope and application
			Categories	Criteria (N)	Maximum Credit	Percent.	Requirement/total score	Rating		
Pearl Community Rating System (Estidama), 2010	Abu Dhabi Urban Planning Council (AUPC)	To promote the development of sustainable communities and improve quality of life, through an integration of the four pillars of Estidama in a collaborative and interdisciplinary approach to master planning.	(i) Integrated development process (IDP) (ii) Natural systems (NS): (iii) Livable communities (LC) (iv) Precious water (PW): (v) Resourceful energy (RE): vi) Stewarding materials (SM) ** Innovating practice (IP)	7 8 17 8 11 11 2	10 14 38 37 42 18 3	6.17% 8.64% 23.46% 22.83% 25.93% 11.11% 1.86%	all mandatory all mandatory +55 credits all mandatory +75 credits all mandatory +100 credits all mandatory +125 credits	1 Pearl 2 Pearl 3 Pearl 4 Pearl 5 Pearl	Stage 1: Design Stage 2: constructing Stage 3: operational	For development projects with 1000 people minimum population
			**20 out of 64 criteria are mandatory							
Green STAR Community, 2012	Green Building Council of Australia (GBCA)	To enhance liveability, local economic property, and delivery of sustainable outcomes.	(i) Governance and Design (ii) Liveability (iii) Economic prosperity (iv) Environment ** Innovation	8 7 8 9 10	28 22 21 29 10	28% 22% 21% 29%	10 20 30 45 60 75	1 star 2 star 3 star 4 star 5 star 6 star	Stage 1:Registration Stage 2: Submission Stage 3: Assessment of Stage 4: Certification of Stage 5: Re-certification (after 5years)	Strategic planning, master planning, town planning, development control, social planning sustainability and environment, economics, and asset management
			** No mandatory credit out of the 38 criteria							
LEED Neighbourhood Development (ND), 2016	US Green Building Council (USGBC); Congress for New Urbanism; National Resource Defense Council	To enhance smart growth, new urbanism in addition to green infrastructure and buildings	(i) Smart location and linkages (ii) Neighbourhood pattern and design (iii) Green infrastructure and buildings **Innovation and design process **Regional priority credit	14 18 21 2 1	28 41 31 6 4	28% 41% 31%	40-49 50-59 60-79 80 and above	Certified Silver Gold Platinum	Stage 1: Conditional approval of a LEED-ND plan Stage 2: Pre-certified LEED-ND plan Stage 3: LEED-ND certified neighbourhood development	For new green neighbourhoods; For ageing brownfield sites into a regenerated neighbourhood; To determine whether statutory regulations are an enabler for sustainable development in that scale of spatial development; To rate and access their proposed development
			**12 out of the 44 criteria are mandatory							
BREEAM Communities, 2012	Building Research Establishment (BRE)	To be a vehicle for design support, as well as assessment, across all building lifecycle stages and infrastructure, including the master planning of large scale development	(i) Governance (ii) Social and economic well being (iii) Resources and energy (iv) Land use and ecology (v) Transport and movement **Innovation credit	4 17 7 6 6	9.3 42.7 21.6 12.6 13.8 7	9.3% 42.7% 21.6% 12.6% 13.8%	<30 ≥30 ≥45 ≥ 55 ≥ 70 ≥ 85	Unclassified Pass Good Very good Excellent Outstanding	Step 1: Establishing the principles of development Step 2: Determining the layout of the development Step 3: Designing in detail	For moderate or large mixed-use; single-use such as housing estates, retail or business parks
			**12 out of the 40 criteria are mandatory							

Source: after BRE (2012), AUPC (2010), GBCA (2012), USGBC (2018)

2.7 Sustainability Indicators

The emergence of indicators is not new as several spheres of development in various fields have evolved variables which are used to gauge or monitor progress. Indicators have been applied in economic, health, education, and transportation sectors among others. For example, the gross national product (GNP) has been recognized on the international radar as an indicator to gauge the economic development of a nation. However, the GNP cannot be a helpful measure to access urban sustainability at the neighbourhood level or at any scale of spatial development. This is because a holistic assessment which considers and integrates all sustainability aspects is required. It is noteworthy that the rate at which a given urban development achieves the goal of sustainability is a function of the targets laid out by policymakers and most importantly how the achievements are measured using indicators.

This sub-section first presents indicators and their roles in the decision-making process, as part of a strategy to deliver sustainability. It examines the various ways through which indicators can be constructed (i.e. the indicator frameworks). It further reviews various approaches through which indicators can be developed from which one was adopted for this study. As a guiding framework, the principles and challenges of developing indicators were further examined.

2.7.1 Overview and Functions

Indicators can be explained from two main paradigms. One, as an operational representation or characteristics of an attribute of a system (Gallopin, 1997). In this study, it refers to what defines or represents a sustainable neighbourhood. The second paradigm is from the technical perspective which sees an indicator as a variable or an aggregation of a number of variables related to a reference value which gives meaning to the values the variables take (Pinter et al., 2012; Singh et al., 2012; Bell and Morse, 2005). This suggests that an indicator is only functional if it has a reference value (Lancker and Nijkamp, 2000) which could be a goal or a target. In this study, the goal is a sustainable neighbourhood while the reference value is a result of how sustainable neighbourhood is perceived or understood in metropolitan Lagos. In other words, it is the combination of these values that neighbourhood sustainability is assumed to be achieved.

Integrating the two perspectives, Waas et al. (2014:5520) posited that "*an indicator is a representation of the characteristics of a given system, by a quantitative or qualitative variable (for example numbers, graphic, colours, or symbols) including its value related to a reference value*". Elaborating this, Science for Environment Policy (2015:8) defined an indicator as "*a parameter, or a value derived from parameters, which serves to provide information about the state of a phenomenon/area*". Figure 2.8 illustrates this in the context of this study.

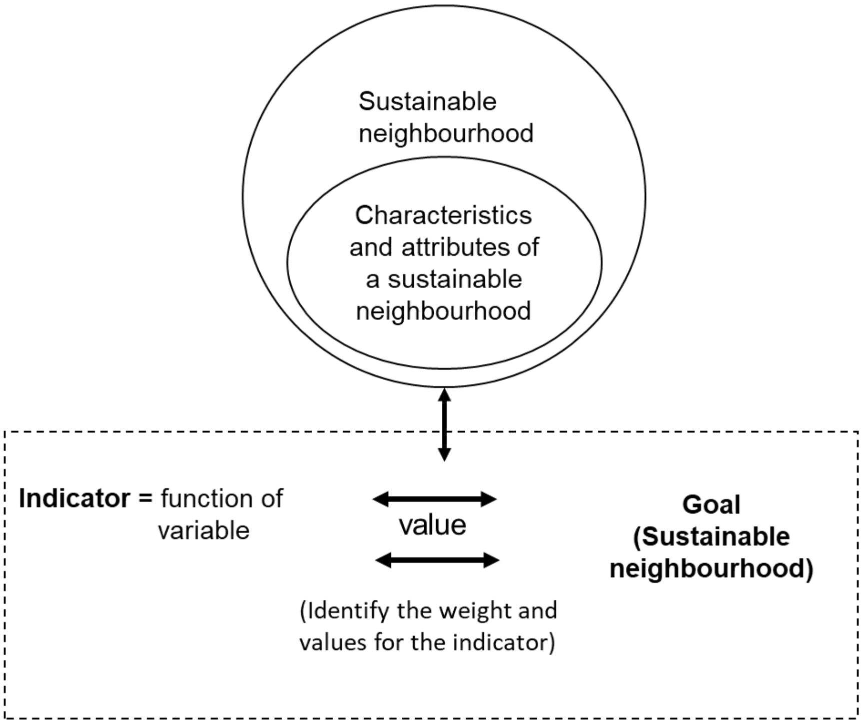

Figure 2. 8: Integrative definition of indicators
Source: Author, 2020

Historically, sustainability indicators (SIs) are traceable to the Rio Summit of 1992 as captioned in chapter 40 of Agenda 21 on the need to establish indicators of sustainable development which will assist in monitoring progress (Bell and Morse, 2008).

"Methods for assessing interactions between different sectoral environmental, demographic, social and developmental parameters are not sufficiently developed or applied. Indicators of sustainable development need to be developed to provide a solid basis for decision-making at all levels and to contribute to self-regulating sustainability of integrated environment and development systems" (UN 1992:346).

It is against this backdrop that a large quantity of indicators has been developed locally at the various scales of spatial development which attests to the important role of indicators in measuring progress towards sustainable development (AlWaer and Clements-Croome, 2010; Bell and Morse, 2008, Science for Environment Policy, 2015; Wu, 2014). Indicators perform various complimentary purposes as a decision-making strategy for sustainability at the neighbourhood level.

One, indicators help to express and communicate information in a structured manner in the decision-making process (Dahl, 2012; Moldan and Dahl, 2007; Hezri, 2004; Munier, 2011). In this regard, indicators make the concept of sustainability observable and demonstrable. For example, the term 'sustainable neighbourhood' can best be observable when there are indicators that express what the concept means. Two, in addition to demonstrating what a sustainable neighbourhood is, indicators help to put to practice the concept (Bell and Morse, 2005; Malkina-Pykh, 2002). That is, it pulls the discussion of sustainability from the abstract formulation and encourages explicit discussions. To this end, it helps to benchmark sustainable neighbourhood in a context. Three, because the development of indicators involves stakeholders' engagement; it therefore, helps to facilitate social learning (Bell and Morse, 2004) as advocated in Agenda 21. Four, the result of the use of indicators in the decision-making process may change the way in which a society measures progress towards sustainability which serves as a leverage point to tackle the root causes of unsustainable development (Pinter et al., 2012).

2.7.2 Complexities of Indicators

The development and application of sustainability indicators have some complexities (AlWaer and Sibley, 2005; Brandon and Lombardi, 2011; Joss et al., 2015) which have raised the following three critical questions:

Who is Responsible for Developing Indicators?

Traditionally, the definitional work of sustainability indicators (SIs) is regarded as the duty of experts, in what is known as the expert-led approach. However, there has been debate on the need to involve non-experts (the public) in the development process of indicators. This is premised on the understanding that to evolve indicators that will be efficient, and as well drive the necessary change, all stakeholders need to be involved in its development because they will contribute the local knowledge needed for implementing the indicator (Brandon and Lombardi, 2011). This is expounded in sub-section 2.7.6.

How many Indicators are Needed?

The number of indicators developed to assess a system (e.g. a proposed neighbourhood) is essential because it is perhaps difficult and irrelevant to use every indicator that may be potentially available (Al Waer et al., 2008). As a result, it must not be too many in order not to discourage its users and it must also not be too few that it will omit some essential issues (Brandon and Lombardi, 2011). There should not be overlaps, which therefore recommends an indicator set that is efficient, applicable, and relevant. As a result, what is necessary is a representative indicator set that cuts across the various sustainability aspects (Science for Environment Policy, 2015).

Which Indicator should be Selected from the Pool of Indicators?

Decision-makers are most times confronted with the challenge of choosing from the pool of indicators which one will best suit their purpose. The way to address this complexity is to start by understanding the various ways that indicators can be used in the d (Science for Environment Policy, 2015). Indicators can serve as explanatory tools, pilot tools, performance assessment, or as a planning tool (Shen et al., 2011; Joss et al., 2015). Put more succinctly, indicators can exhibit the following functions concurrently in an assessment framework which will help in selecting the right choice of indicators needed: One, for incentivising schemes by providing a platform for city authorities to pledge and define their strategies, plans and agenda for sustainability. Two, for strategic visioning as a tool to define city-level strategies for urban sustainability most typically those initiated at the local level. Three, for planning tool-kit as a guide for planners and developers with step-by-step methods and techniques for analysing, designing and implementing urban sustainability projects. Four, for assessing performance against baseline measures and future targets. Five, to enhance community engagement by facilitating the involvement of stakeholders and community members in knowledge sharing and social learning. Six, for certification scheme as it offers standardisation and accreditation to developers, based on prescribed, step-by-step design and assessment methods (Cowley et al., 2013)

In the context of this study, the indicators will perform the highlighted six functions concurrently to enhance sustainable and socially responsible decisions, with emphasis on being a guide for stakeholders involved in urban planning and design, and as well a benchmark in examining the performance of existing and proposed development. Therefore, the characteristics inherently and/or explicitly expressed in an indicator, is crucial to understanding and consequently delivering a planned outcome, such as a sustainable neighbourhood. This provides justification in exploring indicators from this perspective, if only to assure that they communicate what is aspired to by the planning and decision-making process, to deliver sustainable urban neighbourhood.

2.7.3 Indicator Frameworks

In developing an indicator set, it is important to understand the various frameworks through which this can be conceptualised. An indicator framework is a conceptual structure based on sustainability arguments to facilitate the selection, development, and interpretation of an indicator

(Huang et al., 2015). Three types of indicator frameworks have been identified.

One is the Pressure State Response (PSR) or Driving force Pressure State Impact Response (DPSIR) framework where indicators are conceptualised based on the linkages and relationships between man's activities and the environment (Bell and Morse, 2008). Adopted by the European Environmental Agency (EEA), indicators are developed and mapped according to pressures or driving forces which are mainly human activities (e.g. transport, energy, industry); state of the environment and natural resources (focusing on the current conditions of and impacts on the environment); and response from environmental and economic agents to changes in system state.

Two is the theme-oriented framework where indicators are mapped around sustainability themes. Adopted by the World Health Organisation and the World Bank to develop the Healthy Cities Indicators (HCI) and Global Cities Indicators (GCI) respectively, this framework has also been used widely by both developed and developing countries to assess the performance of cities (Lee and Huang, 2007; Tanguay et al., 2010).

Three is the material and energy flow framework where indicators are developed based on the input, output, and the internal dynamics of energy and materials within the systems (NRC, 2004). It appreciates the metabolic activities within a system. An example of this is the Life Cycle Assessment (LCA) which is an approach that assesses the environmental impacts associated with a product from the point of raw material extraction, through production, use, to waste disposal (Finnveden et al., 2009; Baumann, 2010).

The theme-oriented framework was adopted because this study seeks to develop the indicators that could be useful in the decision-making process in planning for a sustainable neighbourhood. Although the developed indicators can still be described using the DPSIR framework, the theme-oriented framework has the benefit of ensuring a comprehensive overview of sustainability. The United Nation Commission for Sustainable Development for example, developed the City Development Index (CDI) using this approach. Also, NSAFs such as the BREEAM Communities, LEED-ND, Green STAR Communities are developed on a theme-oriented framework.

2.7.4 Sustainability Index

Irrespective of which framework typology that was adopted, multiple indicators can be combined using various normalisation and weighing systems to form an index (Wu and Wu, 2012). This is different from an indicator set which is a group of non-aggregated indicators usually organised following a certain indicator framework for a project (Huang et al., 2015). The sustainability index which is also known as single composite indices may focus on the environmental dimension or aspect of sustainability such as the Ecological Footprint. Examples of sustainability index include: China Urban Sustainability Index; City Blueprint; Cities Statistics; Green City Index; Environmental Performance Index; City Development Index; Human Development Index; and Sustainable City Index among others (Science for Environment Policy, 2015; Huang et al., 2015). Also, BREEAM Communities, LEED-ND, and Green Star Communities amongst others are index as they comprise of criteria and indicators which have weight. In the BREEAM Communities, the weights for the criteria (under which there are indicators) are assigned as follows: Governance- 9.3 per cent; Social and economic wellbeing- 42.7 per cent; Resources and energy- 21.6 per cent; Land use and ecology- 12.6 per cent all summing up to 100 per cent (Table 2.1).

A sustainability index helps in the decision-making process as indicators can be prioritised based on their weight (index value). In addition to this, the contribution of each indicator to a sustainable neighbourhood can be determined. From an index, the priorities of various sustainability aspects can be seen and compared with those from another index. Several methods and approaches have been proposed for aggregating and assigning weight to indicators that make up the index. Some of these methods include: analytical hierarchy process; factor analysis, regression analysis, principal component analysis, and conjoint analysis (Bohringer and Jochem, 2007; Jollands, 2006).

The next sub-section examines the approaches of developing a sustainability indicator and index, one of which this study set to explore using metropolitan Lagos as the context.

2.7.5 Approaches for the Development of Indicators

The development of sustainability indicators has greatly been influenced by the methodologies adopted in other disciplines such as economics, social progress, environmental and natural resources among others (Hezri, 2006). Its development involves brainstorming, focus groups, and expert opinion (Guy and Kibert, 1998). However, the following three approaches can be distinguished.

Top-down

Characterised with a clear methodology, the top-down approach is expert-driven initiated primarily by government, and it is based on input from experts. It has epistemological roots in scientific positivism, because it tends to include scientific and quantitative indicators in a way to explain complex and dynamic systems (Turcu, 2012). This is usually done in a closed process setting without the local stakeholders. A stakeholder is an actor that has the influence to affect or is affected by the forward growth of an organization's objectives (Freeman, 1984). The limitation of this approach is that, most times it could easily not capture what the local stakeholders perceive as important to them (Reed et al., 2006). This therefore defeats the purpose of chapter 28 of Agenda 21 which called for the use of indicators developed in consultation with local stakeholders, and further re-echoed by Corbiene-Nicollier et al. (2003) and Zeijl-Rozema and Martens (2010). Most of the indicators of the existing NSAFs were developed using this approach (Joss et al., 2015).

Bottom-up

This approach which draws on the participatory model popular among the post-positivist scholars (Turcu, 2012) has indicators (majorly qualitative) developed by local stakeholders with no clearly defined methodologies (Bell and Morse, 2001). The bottom-up focuses on measuring issues that are linked to individual behaviours such as their satisfaction and preferences in identifying and prioritising indicators. Although public participation and engagement is the bedrock of this approach, it has two main limitations. One, it will not be useful if does not trigger change towards sustainable behaviour. More so, Kelly and Moles (2002) argued that community representatives may become dominant as typical of government institutions in the expert-led approach.

Hybrid

The hybrid approach recommended by various scholars (Bell and Morse, 2008; Bebbington et al., 2007; Hak et al., 2012; Fraser et al., 2006; Reed et al., 2006) combines the methodologies of both the top-down and the bottom-up approaches. Elaborating this approach further, Yigitcanlar et al (2015) posited that the responsibility for developing sustainability indicators is best achieved through a joined-up approach, which is an integration of both the expert-led and the citizens-led models. Allowing the target audience to participate in conceptualising the indicators, will further make them appreciate the results (Bell and Morse, 2001, Rydin et al., 2003).

2.7.6 Principles for Developing Indicators

The process of developing the indicators of a NSAF needs to be guided by a set of principles, to ensure that the uptake of the indicators aids decision towards sustainability. Gibson et al. (2005, 2013), Haapio and Viitaniemi (2008), Reed et al. (2006), Haapio (2012), Hacking and Guthrie (2008), and Brandon and Lombardi (2011) identified some key principles to guide in the process. These include: adequate coverage by integrating all issues that influence the prospects for a sustainable future within the context; public participation in its development; a conscious attempt to change the unsustainable practices, by advocating that new developments contribute to a desirable and durable future; seek mutually reinforcing gains and minimize trade-offs; not be a deviation from the national bibliography, recommendations, national regulations, building codes, cultural heritage, way of living, and building culture.

To have a holistic process in developing the indicators that could be used to compare sustainability in various contexts, the Bellagio Sustainability Assessment and Measurement Principles (known as Bellagio STAMP) emerged in 1996. Initially termed Bellagio's principle, it was a product of harmonisation among various field experts (Sala, et al. 2015). Furthermore, the Bellagio STAMP was developed to seek for better ways and procedures for evaluating sustainable development as canvassed by the World Commission on Environment and Development (WCED) in 1987 (Devuyst 2000). The principle was designed to be used by community groups, non-governmental corporations, national governments, and international institutions. The Bellagio STAMP is to serve as a guideline in the whole process of assessment and specifically in the selection and design of indicators, their interpretation and communication of results (Pinter et al., 2012). Comprising of 8 principles, it raises the following questions which need to be addressed in developing the indicator set of NSAF as highlighted in table 2.2 and further discussed.

Table 2. 2: The Bellagio STAMP and its key questions

Principles	**Question**
Guiding vision	What is the vision of the NSAF?
Essential consideration	Will the indicators cover and address the identified sustainability issues?
Adequate scope	Is the NSAF conceptualised to cover the whole design process in the selection of its indicators
Context-specific indicators	Will the identified indicators be context-specific?
Transparency	Will the indicators communicate clearly to its users in terms of terminology?
Effective communication	
Broad participation	Will the development of the indicators involve consultation with relevant stakeholders?
Continuity and capacity	Will the indicators be designed to be responsive to change and constant review?

Source: after Sala et al. (2015)

Issue of Context

Context plays a significant role in the type of indicators selected for use, or developed, and used in the NSAF (Joss et al., 2015; Gazzola et al., 2011; Gazzola, 2008; Fischer, 2005; Fischer and Gazzola, 2006; Fischer and Onyango, 2012). According to Conte and Monno (2012), context influences the development and implementation phases in sustainability assessment, including the indicators, and how they are used for decision-making. The development phase for instance which involves the understanding and interpretation of sustainability is a function of context. That is, how sustainability is perceived in one context may be different in another context. This perception is mostly based on values, needs, aspiration, cultural inclination, geographical location, or climate, among others. Gazzola (2008) draws attention to the various planning paradigms influenced by cultures, while Fischer (2002) and Hilden et al. (2004) emphasise the significance of distinct legal and administrative aspects which have important procedural and methodological implications for environmental assessments. Knieling and Othengraf (2015) amongst other scholars have provided an authoritative theoretical framework that established the pivotal role of context, in shaping planning frameworks and consequent outcomes, based on empirical analysis of European planning frameworks.

Moreover, there is also a difference in terminology which can vary across context (Du Plessis, 2005). For instance, the term ‘social wellbeing’ which is a global sustainability agenda may have different meanings and interpretations in different countries. Context also plays a further role in the development phase during the process of transferring the interpretation of sustainability into measurable values known as indicators. For instance, the indicators for ‘integrated transport’ or ‘support for the local economy’ in a developed country may be quite different from that of a developing country. The contextual differences influence sustainability assessment which makes it difficult to adopt an existing NSAFs for use in another context. Furthermore, context influences the implementation and uptake of the indicators. Firstly, it attempts to identify the opportunity for integration of the indicators into the existing procedural and substantive framework. This is premised on the argument that a NSAF needs to fit into the existing regulatory framework and not to serve as a replacement (Haapio, 2012). Furthermore, the effectiveness of the existing regulatory framework (in terms of transparency, thoroughness, community engagement, enforcement, and political will) has the potential to affect the overall assessment process. Therefore, context influences a NSAF both in the development of its indicators and implementation.

Reviewing some of the existing NSAFs, Pearl Community Rating System (PCRS) used in Abu Dhabi has a specific category for 'precious water' due to the limited water availability in the region. In fact, this category takes 37 per cent of the total weighting of the framework with such indicators like 'Water Efficient Buildings', 'Storm Water Management', 'Community water use reduction' among others (AUPC, 2010). Also, in LEED-ND, the current challenge of urban sprawl in most parts of the United States was addressed, through targeted indicators. For instance, 'neighbourhood pattern and design' category has the highest percentage, weighing 41 per cent with such indicators like 'Compact development', 'Mixed-used neighbourhood', and 'Walkable streets among others. In addition, LEED-ND also developed the 'Regional Priority Credit' which is targeted to address specific environmental issues with an incentive for developments that address geographically specific sustainability issues (USGBC, 2018). BREEAM communities attempting to address the concerns of social wellbeing introduces key social wellbeing indicators to the BREEAM communities 2012 which is an improvement to the 2008 version of the assessment framework. Table 2.3 presents the targeted indicators in some existing NSAFs.

Table 2. 3: Targeted Indicators in selected neighbourhood sustainability assessment frameworks

Countries	Core/local urban challenges	NSAFs	Targeted indicators
UK	Inadequate social wellbeing; non-engagement of citizens in planning	BREEAM Communities	SE02- Demographic needs and priorities; SE05- Housing provision; SE06- Delivery of services, facilities, and amenities; SE07- Public realm; SE09- Utilities; SE11- Green infrastructure; SE12- Local parking; SE14- Local vernacular; SE15- Inclusive design
USA	Urban sprawl; high dependence on automobile; urban heat island	LEED-ND	NPD C1- Walkable streets; NPD C2- Compact development; NPD C3- Mixed-use neighbourhood centres; NPD C4- Mixed-Income diverse communities
UAE	Limited water supply	PCRS	PW R1- Community water strategy; PW R2- Building water guidelines; PW R3- Water monitoring and leak detection; PW 1.1- Community water use reduction: landscaping; PW 1.2- Community water use reduction: heat rejection; PW 1.3- Community water use reduction: Water features; PW 2: Stormwater management; PW 3: Water efficient buildings

Source: after BRE (2012); AUPC (2010), USGBC (2018)

In addition to recognising the role of context in the choice of indicators, the consideration of the existing substantive and procedural planning framework is also necessary. In BREEAM Communities for example, the Environment Impact Assessment (EIA), Noise Impact Assessment, and Flood Risk Assessment amongst other statutory policies are to be conducted before a proposed development will be considered for certification (BRE, 2012). The

PCRS also made compliance with the Plan 2030 and other Urban Planning Council (UPC) policies compulsory for any development. This suggests that a NSAF can serve as a basis for better understanding, creating awareness, and most importantly, enforcing the statutory requirements in a context as they relate to planning at the neighbourhood level.

Role of Stakeholders

Chapter 28 of Agenda 21 of the Rio conference in 1992 emphasised the need for consultation with stakeholders in planning for urban sustainability (UN, 1992). This implies that, there is a relationship with a degree of influence between sustainability and stakeholder engagement in the urban context. Stakeholders are those who have an interest in an area as they contribute to the wellbeing of that area (Brandon and Lombardi, 2011). Therefore, this raises the question of the level of significance of stakeholder engagement in sustainability discourse and most importantly its assessment. The subjectivity of sustainability has necessitated the need for public participation in developing the indicators of a NSAF through engagement and consultation (Bell and Morse, 2004), where the perception and preferences of stakeholders are captured. This is to achieve the two objectives. One, to contextualise the specialist local knowledge whereby as many stakeholders as possible, will be engaged to investigate their views on sustainability (Moroke et al., 2019; Mathur et al., 2007, 2008). Two is to strike a balance and harmonise the diverse needs of the stakeholders (Sala et al., 2015).

According to Sharifi and Murayama (2013), stakeholders' participation or engagement in the development of the indicators of a NSAF can be in three different stages (Figure 2.9). Firstly, stakeholders may be involved at the time of defining the sustainability targets, and identification of indicators. The structure of a NSAF further calls for the need to investigate stakeholders' perception of sustainability indicators (Bond et al., 2012; Berardi, 2013; Bond et al., 2013; AlWaer et al., 2008).

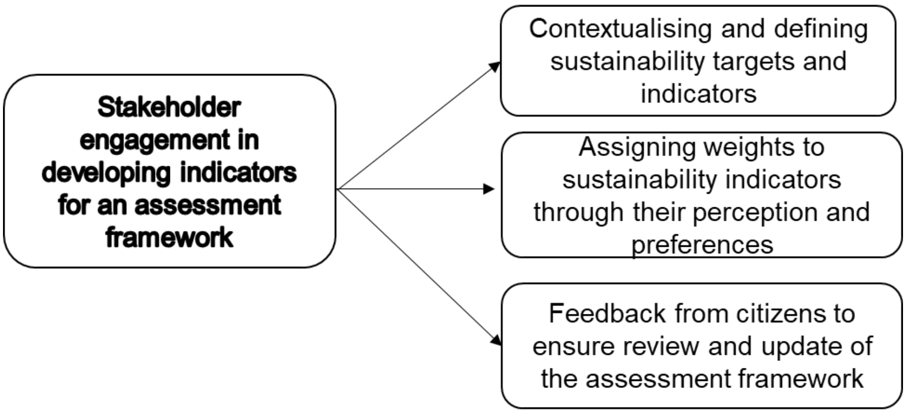

Figure 2. 9: Phases of stakeholder engagement in developing indicators
Source: Author, 2020

Secondly, at the stage of eliciting weights to the sustainability indicators, the participation of stakeholders can be essential. In addition to establishing the perception of the stakeholders on the sustainability indicators to select the suitable indicators, their preferences for the indicators is also crucial to assign weight and prioritise them. Investigation of stakeholders' preference attempts to know the importance of one indicator over another in a pairwise comparison. From this, the weight and reference value (quantitative significance) for each indicator can be determined. A consensus-based weighing can aid and promote the assessment process in terms of legitimacy and capturing of local knowledge (AlWaer et al., 2008). Thirdly, citizens and stakeholders can participate by giving the necessary feedback for relevant updates and review of the NSAF. Focus groups, internetworking, interviews, and questionnaires are some of the techniques through which stakeholders can be involved (Pinter et al., 2012).

For example, Green Star communities was developed through a conglomerate of 46 industry and government peer reviewers; 15 government sponsors (including all government land organizations); and 10 industry sponsors. As it can be observed, the participation was restricted mainly to professionals and core experts with no involvement of the citizens. LEED-ND also adopted a similar approach in its development by involving representatives from three organizations, which are the U.S Green Building Council (USGBC), the Congress for the New Urbanism (CNU), and the Natural Resources Defense Council (NRDC). BREEAM communities which was developed by BRE Global Limited is another expert-led initiative in which there is a standing panel comprising a range of experts who have the expertise to assess BRE Global limited standard schemes in order to ensure a robust assessment framework (BRE, 2012). The Pearl community rating system also adopted the expert-led orientation as it was developed by the Abu Dhabi Urban planning council (UPC).

Establishment of a Clear Vision

Developing the indicator set of a NSAF needs to be driven by a vision e.g. the need to enhance sustainable development through effective decision-making (Pope et al., 2004). In this context, there are two levels of vision. One, there are visions that can be aspired to at the global levels e.g. the Sustainable Development Goals, and the New Urban Agenda. Two, are visions that are peculiar to a context (also known as the local vision). This consideration is important as a NSAF has a dual role of pursuing the global sustainability vision, while also defining the specifics of sustainability within a local context by interlinking both visions (Gibson et al., 2005). What this means is that its indicators should attempt to meet the sustainability agenda as advocated by various global organisations like the United Nations, while also addressing the sustainability challenges as highlighted in the local plans and policies peculiar the context where it is to be used.

For instance, BREEAM Communities, LEED-ND, and the PCRS included a local vision which has to do with the peculiar sustainability challenges confronting the country where the framework was developed (Table 2.4). LEED-ND attempts to address the issue for urban sprawl which has been a dominant urban problem in the United States, with a mandate to enhance smart growth and new urbanism, in addition to green infrastructure and buildings (USGBC, 2016). This further confirms the role of context in the development phase of the indicators of a NSAF.

Table 2. 4: Guiding visions and goals of selected NSAFs

Neighbourhood sustainability assessment frameworks	**Guiding vision and goals**
BREEAM Communities	To be a vehicle for design support, as well as assessment, across all building lifecycle stages and infrastructure, including the master planning of large-scale development
LEED-ND	To enhance smart growth, new urbanism in addition to green infrastructure and buildings
Pearl Community Rating System (Estidama)	To promote the development of sustainable communities and improve quality of life, through an integration of the four pillars of Estidama in a collaborative and interdisciplinary approach to master planning
Green Star Communities	To enhance liveability, local economic property, and delivery of sustainable outcomes.

Source: after BRE (2012), USGBC (2018), AUPC (2010), and GBCA (2012)

Holistic and Comprehensive Consideration of Sustainability Issues

This principle advocates that a NSAF should be holistic and balanced in its approach in developing its indicators by equitable treatment of sustainability issues (Komeily & Srinivasan, 2015). This can be achieved in two ways. Firstly, by integrating all issues that influence prospects for a sustainable future. This is the strategic role that indicators play in a NSAF. Secondly, is by seeking mutually reinforcing gains in the aspect of being a vehicle for appreciating the interdependence of ecology, economy, and the society to generate a harmonized environment (Gibson, 2013).

In BREEAM Communities, environmental issues and concerns have the highest percentage of indicators accounting for 32.4 per cent of its total weighing; LEED-ND- 34 per cent; Pearl community rating system- 57.4 per cent; and Green Star communities- 25 per cent of their total credit. Such high consideration given to environmental issues may perhaps be due to two reasons. One is the fact that sustainable development needs to be embedded within ecological limits (WCED, 1987; Berardi, 2013). Two, most of the prominent NSAFs originated from existing Building Environmental Assessment (BEA) tools which were focused on environmental issues. As a result, few modifications were carried out when the assessment frameworks were extended from the building scale to the neighbourhood scale which warranted the need for more parameters. There have been some noticeable considerations for other sustainability issues in recent versions of the assessment frameworks. For instance, BREEAM Communities 2012 has a more balanced and comprehensive approach to the choice of its indicators compared to BREEAM Communities 2008.

About social wellbeing, which is now been widely and increasingly advocated for in urban sustainability discourse, Green Star communities has the highest percentage of weighting at 25 per cent. LEED-ND has 20 per cent; BREEAM communities and Pearl community rating system have 17.1 per cent and 9.2 per cent respectively. However, some of the assessment frameworks have peculiar indicators to assess social wellbeing suggesting the role of context in the understanding and meaning of sustainability aspects. BREEAM communities for example included ‘SE15- Inclusive design’. This is particularly to encourage the construction of a built environment that optimises accessibility for as many present and future users irrespective of their age, wellbeing, gender, ethnicity, beliefs, disability, and related needs (BRE, 2012). Therefore, this addresses the intergenerational and intragenerational aspects of sustainability. Also, the PCRS used in the United Arab Emirates considered ‘LC9- Improved outdoor thermal comfort’ as a priority for social wellbeing with the highest percentage weight in this category. This may be attributed to the climatic weather condition in that part of the world which is known to be relatively hot, highlighting the context-specificity aspects in NSAFs.

Green Star Communities takes the lead in economic wellbeing with 21 per cent of its weighing targeted at this. BREEAM communities has 14.8 per cent for this category, while LEED-ND has only 1 per cent. This was not considered in the PCRS. BREEAM communities has the highest percentage for transportation consideration with 13.8 per cent with LEED-ND, Pearl community rating system and Green star communities with 11 per cent, 6.2 per cent, and 3 per cent respectively.

To ensure the adherence to some core sustainability issue, most NSAFs have what is known as the ‘mandatory criteria’ or ‘prerequisites’, or ‘required credits’ which are compulsory during the assessment process to ensure the minimum acceptable standard of sustainability for the proposed development. The BREEAM Communities certificate, for example, will not be issued to a proposed development without addressing all the mandatory criteria (BRE, 2012). However, GREEN STAR communities do not have mandatory criteria which promote and gives room for ‘criteria hunting’- a situation whereby developers may decide to pick and implement the indicators at their own convenience. The implication of this is that although a proposal may attain a 5-star certification, it may not have properly addressed some core sustainability issues.

Transparency and Effective Communication

The success of a NSAF depends on its transparency as it helps the public to understand the data and methods employed in the assessment process (Komeily & Srinivasan, 2015). To this end, the indicator set must be developed in a clear and simple language that is easy to understand. It must be free from ambiguity and high technicality. Ideally, it should be friendly with quick interpretation and understanding of its result (Pinter et al., 2012).

Additionaly, information and documents that needed to be supplied prior to the assessment stages should be made known. In BREEAM communities 2012 for instance, the credits available for each assessment issues and its values were made known to the public (table 2.5).

Table 2. 5: Land use and ecology credits in BREEAM Communities 2012

Land use and ecology assessment issue	**Weight**	**Credits available**	**Value of each credit**
LE 01- Ecology strategy	3.2%	1	3.2%
LE02- Land use	2.1%	3	0.7%
LE03- Water pollution	1.1%	3	0.4%
LE04- Enhancement of ecological value	3.2%	3	1.1%
LE05- Landscape	2.1%	5	0.4%
LE06- Rain water harvesting	1.1%	3	0.4%

Source: after USGBC (2018)

In terms of effective communication, the nomenclature of some NSAFs was not clear enough for proper understanding, as to what it really intends to achieve. As a result, a better explanation may be helpful. In Green Star Communities for example, ‘Env 9- Materials’ under the environment category, needs further clarification. ‘SE14- Local vernacular’, ‘SE09- Utilities’, ‘LE02- Land use’ used in BREAM Communities can be better explained in a way that will not give room for multiple interpretations. In contrast, LEED-ND attains a better degree of effective communication in the nomenclature of its categories and credits with such credits like ‘SLL C5- Housing and job proximity’, ‘NPD C9- Access to civic and public spaces’, and ‘NPD C13- Local food production’ amongst others having a clear meaning.

Responsive to Change and Review

This principle advocates that the indicators of a NSAF should be responsive to change with room for continuous learning and improvement. This means that it should be subjected to continuous review and update. This can be enhanced in two ways. One, by monitoring progress as a result of implementing the framework, while also identifying any shortcoming. Two is using the feedback from stakeholders as a major source of information to review and update the indicator set. For instance, the BREEAM communities 2008 version, due to feedback, and consultation with stakeholders (experts) led to the development of BREEAM Communities 2012 which was an improvement in terms of scope and sustainability coverage. LEED-ND developed in 2009 was upgraded with the release of the LEED-ND V4 in 2016. The PCRS developed in 2010 is yet to the upgraded while the Green STAR communities has Pilot versions 0.0 released in 2012; 0.1 in 2014; 0.2 in 2015; versions 1.0 in 2015; and 1.1 (2016).

2.8 Characterising the Indicators of a Neighbourhood Sustainability Assessment Framework

As indicator set forms the main aspect of a NSAF, they help to communicate what a sustainable neighbourhood means to a context where it has been developed. However, the indicator set has some characteristics which can be explored using two perspectives. One has to do with the content of the indicator set. That is, what areas and aspects of sustainability do it cover, and how can each of the indicator in the set be described in terms of function. Two has to do with the relationship of the indicators with one another. For example, in the decision-making progress, how are the indicators prioritised with respect to one another. This section which draws extensively from literature presents four various ways of characterising the indicator set of a NSAF under the two main perspectives as illustrated in figure 2.10.

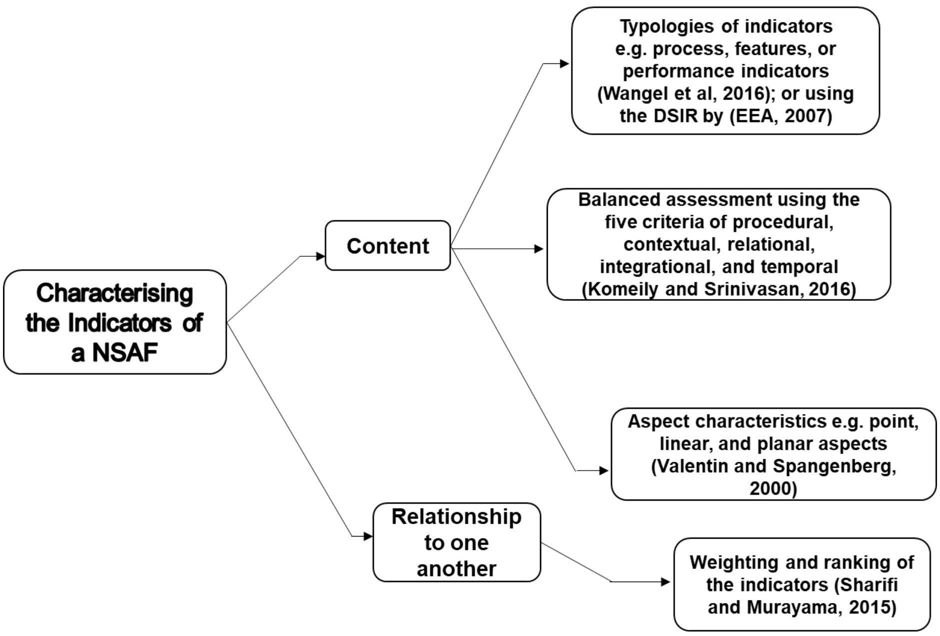

Figure 2. 10: Conceptualising the approaches for characterising the indicators of a NSAF
Source: Author, 2020

2.8.1 Typologies

The typology of indicators can be characterised in three ways.

One is the Driving Pressure State Impact Response (DPSIR) framework which has been widely used as an extension to the Pressure State Response (PSR) developed by the Organisation for Economic Cooperation and Development (OECD). Using the DPSIR, indicators can be transformed to a causal network thereby eliciting meaning and making it easier to communicate to stakeholders, how the indicators are linked to one another (Opon and Henry, 2019; Pakzad and Osmond, 2016). The DPISR framework has the advantage over other indicator frameworks because it helps to better understand how the indicators address the various components of the interaction between human activities and environment. Several scholars (Kirstensen, 2004; Bell and Morse, 2008; and Dong and Hauchild, 2017) have adopted this approach in explaining how the characteristics of different indicators can be used holistically.

In this study, the driving force indicators attempt to address a need and demand of a typical neighbourhood; pressure indicators aim to reduce the demand on the environment and its resources by enhancing sustainable production and consumption pattern; state indicators assess a proposed neighbourhood development in terms of its contribution to enhance the quality or state (S) of the environment; impact indicators assess a proposed neighbourhood development in terms of its consideration to reduce its likely impact (I) on human health; response (R) indicators which are response measures to ensure environment-friendly development and that mitigation measures are taken to prevent the likely adverse effects of the development on the environment. This approach has the potential to provide a compelling framework for understanding the characteristics of an indicator set; with one that matches the DPSIR model. This has the advantage of facilitating the communication and understanding of the various inter-linked and inter-dependent factors at play when considering a sustainable neighbourhood.

Two is by the classification of indicators in typical assessment framework as espoused by Wallhagen et al. (2013) and Wangel et al (2016). In this typology, the character of an indicator could be process, features, or performance indicators. The process indicators describe the important procedures or activities that contribute to the achievement of sustainability outcomes in planning a new neighbourhood. This for example may involve stakeholder engagement which could take place at any of the phases of the proposed neighbourhood. Most times, it could be key strategic planning like scenario analysis; forecast etc. The features indicators describe certain solutions, provision, technology, and components that would contribute to a sustainable neighbourhood. These are most times tangible. They serve primarily to maintain the sustainability of the neighbourhood. Lastly, are the performance indicators which are the expected result following the execution of the process and feature indicators. It suggests in a way how the neighbourhood would perform. This typology has the advantage of comprehensively capturing the key factors in describing the implementation and delivery of a sustainable neighbourhood.

Three is the classification as either qualitative, quantitative indicators or both. According to Waas et al. (2014), quantitative indicators rely on quantitative data providing information numerical data, which are more objective parameters for calibrating positions and status of performance. However, qualitative indicators provide information in a non-numerical manner and have the advantage of being rich in nuanced and contextual descriptions which are amenable to easy or reliable quantification (e.g. direction of travel or perspective). While indicators traditionally are known as quantification tools, there are some aspects such as human experiences that also requires a qualitative approach (Bell and Morse, 2008).

2.8.2 Balanced Assessment

The characteristics of an indicator set can further be explored from the perspective of the degree at which they enhance a balanced assessment. That is, how it ensures or enhances a holistic and comprehensive approach to measuring sustainability. Komeily and Srinivasan (2016) suggested five types of balance. One is the contextual balance which is how the indicators enhance the specificities of each region. That is, how does the indicator set address local issues, values, and aspirations as advocated in Agenda 21. Two is the procedural which focuses on the engagement of all relevant stakeholders in the development, revision, and subsequent implementation of the indicators. That is, are the indicators expert-driven or non-expert driven or both? Three is the integrational which addresses the comprehensiveness of the indicator set in addressing holistically sustainability aspects. That is, consideration for sustainability in a manner that cuts across the relevant dimensions. Four is relational which focuses on indicators that address spatial and social relationships within the neighbourhood and between existing neighbourhoods in terms of infrastructures and amenities. Five is temporal which examines how the indicator set addresses the needs of the present and future generation in terms of intergenerational and intragenerational aspects. For example, the provision of infrastructure and amenities can help to meet current needs, while future needs can be assured by providing a strategy to maintain the infrastructure. The advantage with this typology is that it attempts to intervene in areas where there is contestation and are easily subject to bias, to avoid missing out on a crucial factor that may define sustainability. For example, it is easy to consider sustainability of a neighbourhood by referring to the present generation whilst not associating it to the future or past generations.

2.8.3 Aspects

The Sustainability Pathway (SP) as conceptualised by Valentin and Spangenberg (2000) could also serve as a framework to explore the characteristics of the indicator set of a NSAF. The SP helps to understand the inter-relationship between the dimensions of a sustainable neighbourhood. Dawodu et al. (2017) elaborating this model suggested the following four aspects: One is Point Aspect where an indicator concentrates mainly on one dimension of sustainability. Two is Linear Aspect where an indicator could be indexed to establish a link between any two dimensions e.g. environmental and economic; economic and socio-cultural etc. Three is the Planar Aspect whereby an indicator cuts across the three dimensions.

Four is summative or aggregate which links four dimensions together. However, since sustainable neighbourhood in this study is discussed under three dimensions of environmental, economic, and socio-cultural dimensions, the characteristics of the indicators would be explored in terms of their Point, Linear, and Planar Aspects. The strength in this approach lies in the fact that it helps to better appreciate the multi-dimensional nature of an indicator in the decision-making process. That is, how the uptake of an indicator can deliver more than one dimension (e.g. both environmental and economic) of a sustainable neighbourhood.

2.8.4 Weight and Ranking

Another perspective to explore the characteristics of the indicator set of a NSAF is by examining which of the indicators are highly ranked by the value of their weights. The weight of an indicator gives information about its relative importance (Kondyli, 2010) to other indicators in contributing to a specific output, outcome or phenomenon. This typology approach can be helpful in the following ways. Firstly, indications of rank and weight can be reliably used to prioritise the indicators in the decision-making process of a new neighbourhood. Secondly, the weights and ranks can help create a platform for comparison with similar indicators in other NSAF. This would further help to know if such weight and ranking are only context-based or applicable more universally.

2.9 Decision-making Framework for Neighbourhood Planning in Metropolitan Lagos

The section examines the decision-making framework for neighbourhood development in metropolitan Lagos, which can best be explained under the following sections: (i) policy (ii) regulatory; and (iii) institutional (figure 2.11). More importantly, the section further examines the consideration of sustainability issues in the framework to identify the gap where a NSAF could fit in planning for a sustainable neighbourhood in metropolitan Lagos.

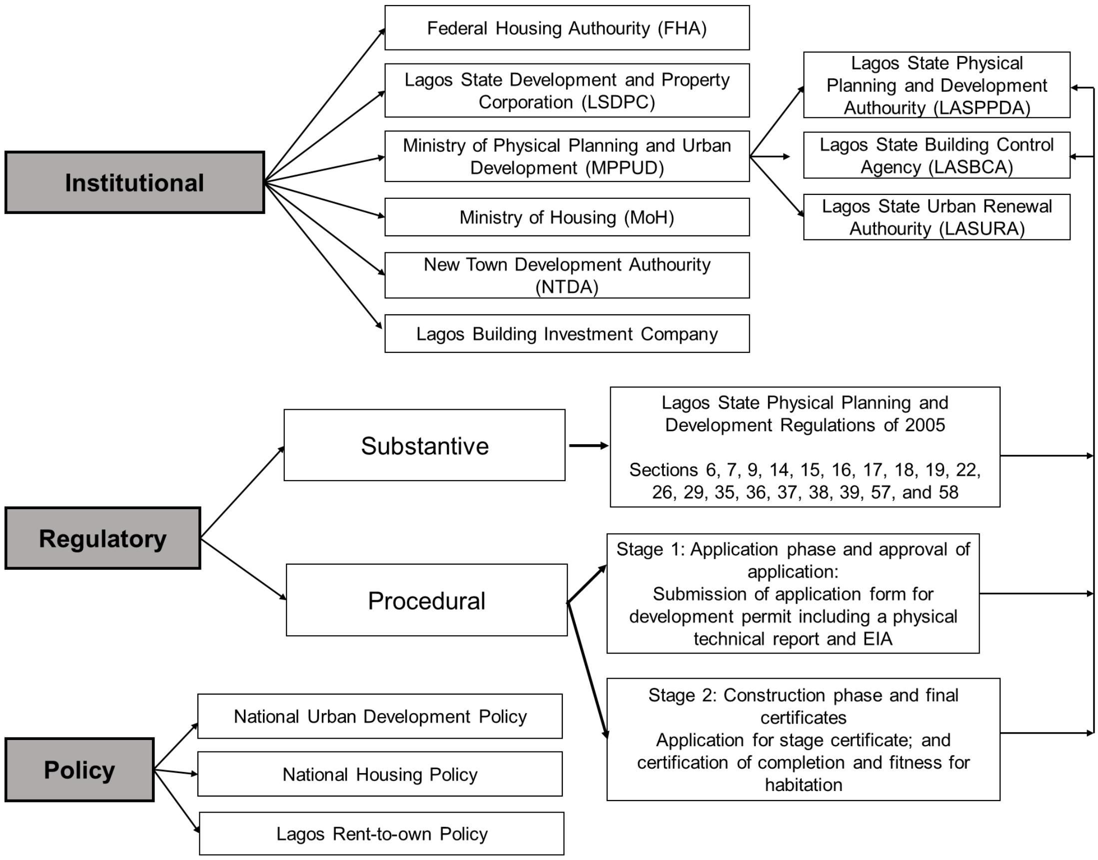

Figure 2. 11: Decision-making framework for neighbourhood planning in metropolitan Lagos
Source: Author, 2020

2.9.1 Policy

Several policies at the federal (national) and the state levels affect and guide planning and decision-making for urban sustainability in metropolitan Lagos. While the neighbourhood scale has not been addressed specifically, such policies are meant to be operationalised at every scale of planning in which the neighbourhood is not an exemption.

National Urban Development Policy

Enacted in 2012, the National Urban Development Policy is with a vision to enhance urban sustainability in Nigeria at all levels of spatial development. According to the Federal Ministry of Lands, Housing, and Urban Development (2014:39), it is to "*promote a dynamic system of urban settlements, which fosters sustainable economic growth, promotes efficient urban and regional planning and development, as well as ensures improved standard of living and wellbeing of all Nigerians*". It served as a framework to institutionalise the following agenda: (i) Effective and sustainable urban planning, design and governance; (ii) Address some basic associated development challenges such as slum development, inadequate social amenities (water, sanitation, and energy), poor urban mobility, and unplanned peri-urban expansion among others; (iii) promote and enhance the potentials of cities in driving economic and social development; (iv) Exploring the current urbanisation to promote sustainable human settlement; (v) Empower the State and Local Governments by building sufficient capacity so as to enhance productivity, collaboration, and innovation (ibid).

National Housing Policy

This was introduced to ensure that all Nigerians own or have access to *"decent, safe and healthy housing accomodation at affordable cost"* (Ocholi et al., 2015:721). This policy has metamorphosed over the years starting from the first National Housing policy in 1991 to the current one released in 2011. Thirteen priority areas of the policy according to its section 1.5.6 are targeted at sustainable housing delivery which are:

(i) Land for housing
(ii) Housing finance
(iii) Building materials
(iv) Affordable housing
(v) Housing supply and demand planning
(vi) Appropriate institutional framework
(vii) Implementation, coordination, monitoring, evaluation, and review
(viii) Construction methods
(ix) Sustainable construction workforce
(x) Maintenance
(xi) Construction costs
(xii) Infrastructural estate development financing
(xiii) Data and statistics for housing

The land for housing priority, for example, is to make serviced land with secured tenure easily available, accessible, transferable, and at an affordable price for housing development. The affordable housing priority is to ensure that all income groups have access to decent housing with the necessary institutions in place. The policy also attempts to establish a reliable and comprehensive database for generating statistical information for housing development. However, the implementation has been a challenge because it is a policy and not a regulation. Although some of the aspects raised could guide in the development process of a new neighbourhood, it would only compound the decision-making problem. This is because the level of consideration to be given to each priority is not stated, whilst the decision-making process is always characterised with the challenge of determining the priority of one aspects over the other. Therefore, this suggests the need for a mechanism that integrates and prioritises the policies, and can then be operationalised in the decision-making process of a new neighbourhood.

Rent-to-Own Policy

The rent-to-own policy introduced at the state level is to address affordability which is an aspect of a sustainable neighbourhood. This is aimed at ensuring that housing is readily available, accessible, and affordable for the low- and middle-income earners. Through this policy, a prospective home-owner makes a 5 per cent down payment, takes possession, and then pay up the remaining balance as rent towards the ownership of the property over a period of 10 years.

2.9.2 Regulatory

The regulatory framework can be discussed under two main headings.

Substantive

This is guided by the Lagos State Physical Planning and Development regulations of 2005. Comprising of eighty-one sections, it spells out clearly the regulations for all types of development such as residential, commercial, and industrial among others. Although large or medium scale (master-planned) housing neighbourhoods (the focus of this study) were not specifically mentioned in the document (which questions the need for a dedicated framework for planning at this scale), a review of the regulations showed some sections that are applicable at the planning and design phases of a new neighbourhood (Table 2.6).

Table 2. 6: Regulatory framework for decision-making windows in metropolitan Lagos

Decision-making windows (Development phases)	**Extracts from Lagos State Physical Planning and Development regulations of 2005**
Planning and design phase	Sec 14: Permissible development
	Sec 15: Permissible setback to boundary line
	Sect 16: Setback to public utilities
	Sec 17: Building coverage
	Sec 18: Provision of landscaping
	Sec 19: Permissible dwelling unit
	Sec 22: Parking requirements
	Sec 23: Building height
	Sec 26: Conformity to approved area layout
	Sec 35: Space standard
	Sec 36: Requirements for High rise
Approval phase	Sec 6: Planning technical report
	Sec 7: Environmental Impact Analysis Report
	Sec 9: Insurance Policy
Construction and post-construction phase	Sec 37: Certificate of fitness for habitation
	Sec 38: Stage of certification
	Sec 39: Certificate of worthiness
	Sec 57: Mandatory test on concrete cubes and reinforcement
	Sec 58: Method of construction and development

Source: after Lagos State Physical Planning and Development Regulations of 2005

In the planning of a neighbourhood in the excess of 0.5 hectare in metropolitan Lagos, an Environmental Impact Assessment (EIA) needs to be conducted. The EIA involves a process which identifies, predicts, and evaluates the potential impacts associated with a proposed development at the appropriate stage which are addressed before a decision is made on the project (Nwoko, 2013). As captured in principle 17 of Agenda for the 21st century (Agenda 21), the EIA is to be undertaken for any proposed development that is likely going to have a significant adverse effect on the environment. The EIA which has been used globally with its implementation in over 100 countries (Jay et al., 2007) became effective in Nigeria in 1992 when the EIA Act No. 86 was promulgated.

The EIA is conducted in the following stages according to (Echefu and Akpofure, 2010):

(i) Screening stage to identify potential environmental effects of the project;

(ii) Scoping to determine the spatial and temporary dimensions of the effects;

(iii) Conducting a baseline study to know the environmental condition of the location prior to project implementation (these also include the socio-economic, traffic or transportation study);

(iv) Preparing a detailed assessment report (this would include the mitigation measures due to potential impacts on land, water resources, air environment, waste generation, noise generation, transportation, sensitive environmental issues, socio-economic environment, health and safety among others).

(v) Carrying out a panel review of the EIA report; (vi) Obtaining authorisation for development.

It is important to note that public participation (although not indicated in the statutory regulations), takes place in two stages in the EIA process, prior to the submission of the detailed assessment report and at the panel review phase.

However, while it can be said that the government has established these regulations to guide physical development in metropolitan Lagos, there is still more to be done in terms of ensuring the delivery of a sustainable neighbourhood (Jambol et al., 2013). For example, at the planning and design phases, concerns like a strategy for waste management; provision of social amenities and infrastructure; inclusive design; and brownfield remediation among other sustainability aspects need to be integrated to enhance the delivery of sustainable neighbourhoods. Previous studies (Jiboye, 2010; Olotuah and Bobadoye, 2009; Ibem et al., 2015; and Ibem and Amole, 2013) have canvassed for the need to establish the sustainability indicators that could guide in the planning of neighbourhoods in metropolitan Lagos.

Procedural

The regulatory framework can also be discussed under the procedural aspect. The Lagos State Physical Planning and Development regulations of 2005 has certain sections that have to do with the application procedure to be undertaken for a proposed development controlled by the Ministry of Physical Planning and Urban Development (MPPUD). For a development, such as medium or large-scale housing neighbourhood, the following sections of the physical planning and development regulations of 2005 are applicable: Sections 2, 4, 5, 10, 11, 21, 25, 64, and 72.

The procedural framework is explained in the following stages:

Stage 1: Application phase and approval of application: The developer submits application form for a development permit with the following documents: (i) Building drawings or detail of the proposed development, including architectural, structural, mechanical, electrical drawings, and the location plan; (ii) a physical technical report of the proposed development; (iii) Environmental Impact Assessment Report; (iv) A survey plan. The submitted application is thoroughly checked to ensure that it adheres with the regulations and standards for permissible setbacks to the property line and other utilities; building coverage; provision for landscaping; permissible dwelling unit; parking requirements; and height of buildings among others. A development permit will be granted based on meeting above requirements.

Stage 2: Construction phase and final certificates: On getting a development permit, the developer will be expected to give a 7-day notice in writing to the authority of his intention to commence construction. A development permit granted can be revoked under certain conditions such as if the development contravenes any of the provisions of the Land Use Act, 1978 or if it has been overtaken by overriding public interest. At the completion of each stage of building construction, the developer shall obtain a stage certificate of satisfactory execution. Also, every developer on completion of the project will apply for a certificate of completion and fitness for habitation before it is occupied which shall be signed and duly authorized by a registered staff of the Lagos State Building Control Agency. Before occupation of the development, an electrical or mechanical engineer registered to practice in Nigeria shall issue a certificate of worthiness for electrical and mechanical.

2.9.3 Institutional

The institutional framework comprises of stakeholders for neighbourhood planning in metropolitan Lagos. These are the key federal and state government ministries and agencies which serve as channels through which government intervention for meeting housing needs can be actualised.

The federal-owned institutions include: (i) Federal Housing Authority (FHA) involved in the production of medium or large-scale housing neighbourhoods in metropolitan Lagos. They perform administrative roles such as allocation, supervision, and maintenance of the Federal housing Estates; (ii) Federal mortgage bank to provide loan for housing research, construction, and delivery; (iii) The Nigerian Building and Research Institute to make adequate research into housing construction and delivery; and (iv) Standard Organisation of Nigeria: responsible for ensuring the delivery of standard materials and buildings.

The state-owned institutions are discussed:

Lagos State Development and Property Corporation (LSDPC)

It is one of the first agencies responsible for housing production in Lagos. Established under the LSDPC Edict No. 1 of 1972, it has the following statutory responsibilities:

- To acquire, develop, hold, manage, sell, lease or let any property movable or immovable within the state;

- To provide and maintain roads, footways, bridges, drains and sewers on its estates until a local authority takes over;

- To establish a Home-Ownership Saving Scheme in respect of any housing estate or building owned, constructed and managed by the Corporation

Ministry of Physical Planning and Urban Development (MPPUD)

Established in accordance with the Lagos State Urban and Regional Planning and Development law 2010, it is the main regulatory body saddled with the responsibility of ensuring control over development with a view to enhancing a liveable environment.

Some of its statutory responsibilities that have to do with housing neighbourhood include:

- Initiation, formulation and implementation of physical planning, Urban Development and Urban renewal policies and programmes;

- Preparation of Regional, Master, Model City Plans (MCP), Action and Development plans for Excised Villages;

- Granting of approval and Monitoring of Layouts and Development Schemes for both Government and Private Estates;

- Site selection for Government Agencies and other Institutions.

The ministry has been responsible for the development of model city plans which were designed to guide development. The aim of the model city plans is to check the rate of deterioration and decay and trigger new and sustainable settlements (Emza and Oluwatayo, 2014). They are also to prevent environmental hazards such as flooding, haphazard development while ensuring adequate provision of infrastructure and amenities. In order to ensure adequate legal backing for the model city plans (see figure 15) as all development in an area must adhere to the one designed for that area. The Lagos State Model City Development Law was enacted in 2009, in order to ensure that development within a jurisdiction conformed to the model city plan designed for that area. The following three agencies are under the supervision of the Ministry of Physical Planning and Urban Development:

One is the Lagos State Physical Planning and Development Authority (LASPPDA) which is responsible for granting of approval and monitoring of layouts and development schemes; site selection for government agencies and other Institutions to build houses on. Two is the Lagos State Urban Renewal Authority (LASURA) which amongst others is responsible for Directing and monitoring of all resettlement schemes in redevelopment programmes; and monitoring, initiation and review of Lagos State laws on slum upgrading and regeneration. Three is the Lagos State Building Control Agency (LASBCA) which amongst other functions is responsible for: (i) building control; (ii) approval to commence construction after obtaining development permit; (iii) inspection and certification of various stages of building construction; (iv) and issuance of certificate of completion of building construction and fitness for habitation

Ministry of Housing (MoH)

The Ministry of Housing established in 1999, was with a vision to provide adequate and good quality housing for residents of Lagos, coupled with the need to facilitate easy access of citizens to homeownership (LASG, 2016). Some of its ministerial responsibilities include: One, provision of quality housing for Lagos State residents. Two, provision of infrastructures in Government housing estates. Three, supervision and maintenance of existing Housing Estates. Four, collaboration with the Private Sector in the Provision of Housing.

The Lagos Ministry of Housing has been responsible for the production of a few large and medium scale neighbourhood developments (see figures 2.10, 2.11, 2.12, 2.13).

Figure 2. 12: Hon. Olaitan Mustapha Scheme, Ojokoro, metropolitan Lagos. Source: Ministry of Housing (2017)
Source: Author, 2018

Figure 2. 13: Sir Michael Otedola Estate, Epe. Source: Ministry of Housing (2017)
Source: Author, 2018

Figure 2. 14: Chois City, Agbowa Lagos. Source: Ministry of Housing (2017)
Source: Author, 2018

Figure 2. 15: Igbogbo Housing Estate, Ikorodu Lagos. Source: Ministry of Housing (2017)
Source: Author, 2018

New Towns Development Authority (NTDA)

The New Towns Development Authority (NTDA) was established in 1981 through the Lagos State Government Official Gazette Extra-Ordinary No. 19

volume 16 to effectively implement the planned growth of Lagos State, and to encourage private initiative in housing provision, while also developing new towns by designing their layout (see figures 20, 21, and 22) to cater for growing population (LASG, 2016). In addition, the agency is to provide the area (whose layout has been approved) with the necessary infrastructures in what is known as 'site and services'. Its role in housing delivery is to provide new towns (or layout) with necessary infrastructures in what is known as 'site and services'.

Lagos Building Investment Company (LBIC)

The Lagos Building Investment Company (formerly known as Lagos Building Investment Corporation) owned by the Lagos State Government was established in 1980, as a corporate entity and saddled with the responsibility of providing mortgage finance facilities to beneficiaries of the various low-cost housing schemes built by the Lagos State Government between 1979 and 1983. The company became a Primary Mortgage Bank (PMB) with the promulgation of the mortgage institution Act No. 53 of 1980. In addition to providing over 22,000 mortgages since its establishment, the bank has played a major role in the delivery of over 310 housing units through construction finance and joint development programme. Other services rendered by the LBIC include: (i) Mortgage loan; (ii) Home renovation loan; (iii) Real Estate Construction Finance; and (iv) Mortgage advisory service among others.

This section has served the purpose of showing that indeed, there are regulatory and policy provisions for considering and integrating what can be construed as elements of sustainability when planning for neighbourhoods. However, they are segregated and variously distributed across institutions, regulations, and policies, meaning that none of these are encapsulated in a single tool such as NSAF. The implication is that when delivering a neighbourhood, it is likely that all relevant factors are not found in a consolidated document that can be under a single mandate which is easily monitorable and enforceable.

2.9.4 Consideration of Sustainability Issues

A review of the decision-making framework indicates that there is room to integrate some sustainability indicators and aspects as espoused by Oduwaye (2009) and Babalola et al. (2019). For example, in terms of the policy, none of the thirteen areas of focus of the sustainable housing programme in Nigeria addresses the need for all proposed development to be executed within the environmental limits. This raises a question and as well a concern of how the housing programmes would thrive in the absence of a sustainability framework. Although, while key issues raised in the policy were more on liveability, which a developing country like Nigeria needs, emphasis should also have been given to ecological aspects which is an integral part of sustainability.

There is also enough evidence in terms of the government interest in housing with the plethora of ministries and agencies as discussed earlier. However, what is lacking is a council or institution with the regulatory function of ensuring sustainability, monitoring progress, and facilitating research and development (Ogunsote et al., 2011) as observed in some countries including South Africa. Examples of such institutions include Green Building Council of Australia (GBCA); Green Building Council of South Africa (GBCSA); US Green Building Council (USGBC); and UK Green Building Council among others (UKGBC).

Also, the current substantive framework which only has the EIA as the tool to evaluate a proposed development also needs to be examined. It raises a question of what degree does EIA integrate sustainability at the neighbourhood scale? Nwokoro and Onukwube (2011) advocated for its expansion to include consideration of all sustainability aspects in the decision-making process of new development. Corroborating this position, the role of the EIA as essential in planning for a sustainable neighbourhood has been recognised in some NSAFs as discussed in section 2.7.6. For instance, the BREEAM communities used in the UK makes the EIA compulsory for all neighbourhood development.

In metropolitan Lagos, the EIA conducted is to identify and predict the likely environmental, social, and economic impacts of a proposal, and then justifies how the effects can be mitigated. Meanwhile, a NSAF works on the principle of setting the targets at the beginning of the design process, and the expected score to be achieved ensuring that the design of the proposed neighbourhood meets the score. In contrast, EIA most times result in a trade-off of some criteria or indicators so far it can be justified which most times result in weak sustainability. That is, a situation where economic benefits and gains take priority over environmental consideration. In addition, Nwoko (2013) identified seven shortcomings of the EIA as implemented in metropolitan Lagos: limited scope of EIA review; inadequate screening and scoping; poor quality of EIA reports; weak public participation; non-availability of baseline data; inadequate implementation of mitigation measures and monitoring; and extensive politicisation of the EIA process. However, this is not to discard the EIA, because it has a defensive role in ensuring that the proposed neighbourhood imposes no significant effects which cannot be mitigated.

Overall, if the neighbourhood scale is to be the building blocks for urban sustainability in metropolitan Lagos, there is need to develop and explore the characteristics of the indicators of a dedicated NSAF for decision-making, unlike the EIA which applies to all development types. This creates an avenue for the involvement of stakeholders in the development process of such indicator set which is important for planning neighbourhoods in the twenty-first century. While institutional stakeholders has been well defined (as reviewed in section 2.9.3), residents which are the consumers of neighbourhood development can be characterised using the criteria such as income group; age; and cultural inclination amongst others which perhaps might influence the decision-making process. It is necessary to stress that some neighbourhood developments have been left unoccupied, due to the dissatisfaction of people who were meant to live in those places as they were not engaged during the planning and development phases.

2.10 Distilling the Indicators for Sustainable Neighbourhood

This study adopted a two-phase hybrid approach (figure 2.16) in developing the indicator set that can be useful for decision-making in metropolitan Lagos having discussed the various approaches in section 2.7.6,. The hybrid approach was selected for the following reasons: One, it enhances the combination of different kinds of knowledge and perceptions from stakeholders regarding what defines a sustainable neighbourhood in metropolitan Lagos. Two, it enhances participation which is a democratic principle as canvassed by Agenda 21. Three, it creates an opportunity for learning, empowerment, and ownership (Bebbington et al., 2007; Bell and Morse, 2001; Fraser et al., 2006). That is, stakeholders can have input in identifying the indicators that define where they live. Such a forum provides awareness of sustainability as well as learning of some of its aspects at the neighbourhood level. The technique for operationalising the hybrid approach in this study is presented in figure 2.16.

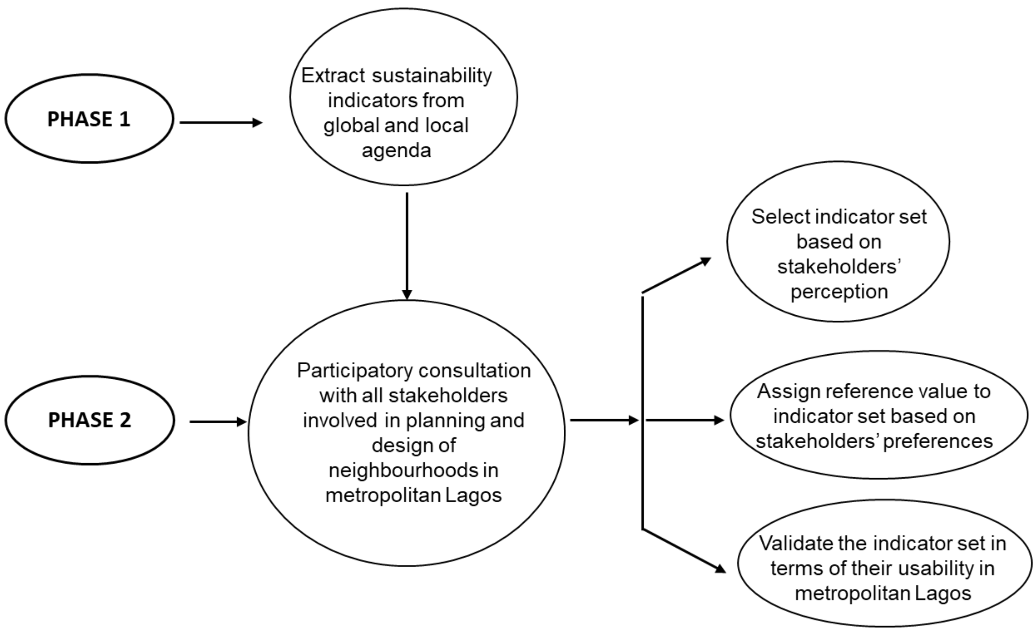

Figure 2.16: The hybrid approach methodology
Source: Author, 2020

Consequently, this section delivers phase 1 which is to identify generic sustainability indicators at the neighbourhood level from literature. This addresses the first research objective of this study. To achieve this, sustainability themes were extracted before identifying the indicators through which these themes can be integrated into the decision-making process in planning for a sustainable neighbourhood. In doing this, the following agendas were examined because they form the pillars at various scales of spatial planning at the international (global), regional, national, and local levels (figure 2.17). Although not specifically designed for the neighbourhood scale, some of their key targets can be observed at neighbourhoods in addition to being the building blocks of urban areas.

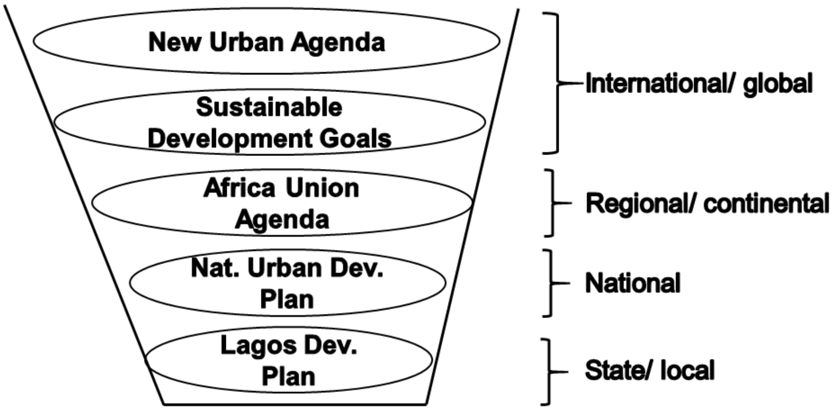

Figure 2.17: Policy documents and agenda from international to local
Source: Author, 2020

At the international level, is the New Urban Agenda adopted at United Nations Conference on Housing and Sustainable Urban Development (Habitat III) in October 2016 in Quito, Ecuador, which provides a policy framework that lays how urban areas should be planned and managed to enhance sustainable urbanisation (UN-Habitat, 2016). The agenda comprises of some criteria and parameters that define a sustainable urban area. This is applicable in this study by the position of metropolitan Lagos being one of the most populated megacities in the world where global standards and visions for sustainable urban areas can be applied. Also at this level, is the Sustainable Development Goal 11 with a focus on delivering sustainable communities. With eleven targets, it is one of the SDG goals (the 2030 Agenda for sustainable development by the United Nations) presented in 2015, as a plan of action for people, planet, and prosperity (UN, 2015). Some of the targets include: adequate, safe and affordable housing; inclusive and sustainable urbanisation; and universal access to safe public spaces amongst others.

At the regional level, is the Africa Union Agenda 2063 proposed in 2014 which highlighted 7 key aspirations to be met by 2063 to enhance sustainable development in the African region. The agenda was triggered by the rapid urbanisation in the continent between 1960 and 2010 with a prediction that the population will triple in the next 50 years (AUC, 2014). It is expedient to consider the key issues raised in this agenda as it relates to metropolitan Lagos because of its position as the fastest-growing megacity on the continent.

At the national level is the National Urban Development Policy developed with a vision to enhance sustainable urban planning and design in Nigeria at all levels of spatial development. The National Urban Development Policy is to:

"promote a dynamic system of urban settlements, which fosters sustainable economic growth, promotes efficient urban and regional planning and development, as well as ensures improved standard of living and wellbeing of all Nigerians" (Federal Ministry of Lands, Housing, and Urban Development, 2014:39-40).

It was developed with the Road Map for Lands, Housing and Urban Development to institutionalize the following sustainability agenda: effective and sustainable urban planning, design and governance; address some basic associated development challenges such as slum development, inadequate social amenities (water, sanitation, and energy), poor urban mobility, and unplanned peri-urban expansion among others; promote and enhance the potentials of cities in driving economic and social development; exploring the current urbanisation to promote sustainable human settlement; and empower the State and Local Governments by building sufficient capacity so as to enhance productivity, collaboration, and innovation (ibid).

Finally, at the local level is the Lagos State Development Plan (2012-2025), which is a policy document prepared to provide a clear direction for the growth and development of Lagos up to 2025. Although the development plan was proposed for Lagos state at a high strategic level, the four key issues of the plan (economic growth; infrastructure development; social development and security; and sustainable environment) are applicable to planning at the neighbourhood scale (LASG, 2013).

The review of these agendas was done in two stages.

Stage one was a detailed study of each of the agendas, and the identification of sustainability themes applicable to planning at the neighbourhood level only which were subsequently recorded in a table.

At the second stage, the identified 26 sustainability themes were clustered under 10 overarching themes (table 2.7). These themes further gave an understanding of how sustainable neighbourhood can be discussed at the neighbourhood level. This is as a result of the fact that the various agendas selected at various levels of administration were helpful in ensuring that both global and local values were captured.

Table 2. 7: Themes that emerged from global and local documents are clustered to have overarching themes

Source	Themes	Overarching themes
New urban agenda	Basic services for all	Infrastructure and maintenance
Lagos State development plan	Infrastructural development e.g. transportation	
SDG11 Target 7	Support links between urban, peri-urban and rural areas	
National Urban Development Policy	Adequate social amenities	
New urban agenda	Equal opportunities with no discrimination	Inclusiveness
Africa union agenda	Inclusive growth and sustainable development	
Africa union agenda	Good governance and equity	
Africa Union agenda	People-driven development	
New urban agenda	Resilient to reduce risks and impact of disasters	Resilience
SDG11 Target 5	Reduce the number of people affected by disasters	
SDG11 Target 8	Increase integrated policies and plans towards mitigation and adaptation to climate	

	change	
SDG11 Target 9	Building sustainable and resilient buildings, utilizing local materials	
New urban agenda	Measures that support cleaner cities	Waste management
SDG11 target 3	Inclusive and sustainable urbanisation	Green innovations
New urban agenda	Action to address climate change by reducing greenhouse gas emission	
New urban agenda	Promote safe, accessible, and green public spaces	Liveability and security
SDG11 Target 1	Adequate, safe and affordable housing	
SDG11 Target 6	Provide universal access to safe public spaces	
National Urban Development Policy	Urban mobility	
National Urban Development Policy	Security of lives and property	
Lagos State Development Plan	Economic prosperity	Economic growth
National Urban Development Policy	Employment opportunity	
SDG 11 Target 8	Increase integrated policies and plans towards mitigation and adaptation to climate change	Resource efficiency and biodiversity conservation
Africa Union agenda	Promotion of strong cultural identity, common heritage, values and ethics	Cultural values
SDG11 Target 4	Safeguard the world's cultural and natural heritage	
SDG11 Target 1	Adequate, safe and affordable housing	Affordability

Source: Author, 2020

However, as some of these themes only provide information of how sustainability concept can be understood at the neighbourhood scale (that is, its interpretation), there is need to identify the indicators which could tell if a proposed development is doing well enough in terms of consideration of overarching themes at the decision-making window. This implies that the focus is on ex-ante indicators which helps to access the effects of decisions well in advance, and therefore supports choice between various alternatives before they are practically implemented.

In the context of this study, the sustainability indicators identified would help to guide the planning process of a new neighbourhood in ensuring that sustainability issues are covered. This is quite different from ex-post indicators which provide information after decisions have already been taken while evaluating the practical implementation of such actions (for instance after construction of the neighbourhood).

In the process of identifying the indicators, an overlap was avoided by ensuring that indicators which seem to assess the same concern were clustered under one indicator, which gives a summary of the indicators under it. Fifty indicators emerged from the overarching themes in which some degree of overlap was still noticeable (Table 2.8; column 2). To this end, the indicators were regrouped to 25 indicators (column 3) in what in some context is referred to as 'headline indicators' as they give the summary of other indicators related to them.

Table 2. 8: Developing the indicators from the overarching themes

Overarching themes	**Indicators**	**Overarching indicators**
Infrastructure and maintenance	• access to public transport • bus stops and shelter • health centres; • schools; • ICT; • water and electricity • neighbourhood market	Social amenities and infrastructure e.g. clinics, schools etc
	• Potable water	Access to potable water
	• street linkages • safe and appealing pedestrian and vehicular routes	Diverse mobility options
	• Connected and open	

	community • Housing and job proximity • mixed-used neighbourhood, street network; • proximity to amenities	Nearness to social amenities and infrastructure
	• Routine maintenance of infrastructure	Strategy to maintain infrastructure
Inclusiveness	• Physically-challenged facilities • Stakeholder engagement	Inclusive planning and design
	• appealing pedestrian streets • walkable streets; • sidewalk and trails • street trees	Friendly pedestrian lane
Resilience	• durable construction material	Quality of material
	• air quality • water quality	Pollution control strategy
	• flood risk assessment; • biodiversity and wetland conservation	Environmental Impact Assessment
Waste management	• waste recycling and re-use strategy; • organic and hazardous waste management	Waste collection and management
Green innovations	• Clean energy system	Use of renewable energy systems
Liveability and security	• Community centre; religious buildings etc	Provision of outdoor spaces and buildings for congregation purposes
	• safe neighbourhood	Security of lives and properties
	• recreational open space • neighbourhood garden;	Neighbourhood square
Economic prosperity	• local job opportunity; • production of local goods	Support for a home-based business
	• low operational and	

	maintenance cost; • readily available technology	Cost of construction, operation, and maintenance
	• Number of shops	Active frontages for commercial activities
Affordability	• Affordable housing • Housing density ratio	Home affordability
Resource efficiency and biodiversity conservation	• energy management strategy; • water management strategy;	Efficient use of resources
	• Site selection • Brownfield remediation	Greenfield preservation
	• land use and neighbourhood design	Effective land usage
Cultural values	• use of local building material and form • organic architecture;	Use of locally-made material
	• use of public art; • retention of local vernacular; • recreational open space	Aesthetics (public arts and landscape etc)
	• Subsistence food production	Home garden for food

Source: Author, 2020

Going forward, the goal of each of the indicator was highlighted with the description as well (table 2.9). This similar approach of developing indicators was adopted by Turcu (2012); Shen et al. (2011); Santos et al. (2017); Al Waer et al. (2014).

Table 2. 9: The goal and assessment criteria of the overarching indicators

Overarching Indicators	**Goal/Objectives**	**Assessment criteria**
Social amenities and infrastructure e.g. clinics, schools etc	Enhance a good living condition	- Evidence of survey of existing neighbourhoods to know which facilities will be required for the proposed neighbourhood - Site plan of neighbourhood showing amenities based on the survey -Infrastructural plan of the proposed neighbourhood -A detailed spatial analysis of the amenities to be provided showing the capacity
Access to potable water	For human consumption and domestic uses	- Each dwelling connected to a water source -A water treatment plan for the proposed neighbourhood
Diverse mobility options	Encourage different means of movement that are environment-friendly	-A mobility plan showing the layout and design of streets which promotes sustainable modes of transportation such as walking and cycling -A transit-oriented development - Connection to existing road and routes in the neighbourhood area
Nearness to social amenities and infrastructure	Enhance easy access by residents	-A considerate travel time to access neighbourhood amenities - Site plan showing that amenities are within walking distance from dwelling units through safe pedestrian routes.
Strategy to maintain infrastructure	For longevity and continued function of amenities and infrastructure	A detailed management plan for facilities such as road, drainage, waste treatment plan, and for amenities like schools, health centres, and other public buildings
Inclusive planning and design	Enhance equity through public participation and take into consideration certain users such as old people, the physically challenged, etc	- Evidence of consultation with necessary stakeholders (e.g. local authority; residents or community representative of an existing neighbourhood) in the design of the neighbourhood -Design consideration for the aged, young, and physically-challenged

Friendly pedestrian lane	Encourage walking and reduce air pollution that comes from the use of cars	- Design of streets that are secured by natural surveillance - Design of streets that are appealing e.g. using landscape elements - Use of pedestrian crossing to ensure the safety of users - A clear and appropriate sign for vehicular, cycling, and pedestrian routes
Quality of construction material	For structural balance and durability while also enhancing the safety of residents	-A specification note showing the quality of material to be used for construction to ensure that it meets the required standard
Pollution control strategy	Preserve the environment for present and anticipated future needs	Noise pollution Noise impact assessment showing: -The sources of noise to the site and how they can be addressed -Means to reduce on-site noise in order not to affect noise-sensitive areas near the site e.g. hospitals, schools, places of worship etc. -Design decisions to minimise noise e.g. use of landscape elements; acoustic in congregational buildings -Policies to reduce noise from congregational buildings, and music vendors -A commitment to achieving a reasonable rating noise level -Site plan showing expected noise areas (on and off-site) and mechanisms to address it. -Plan to mitigate potential vehicle noise disturbance through road layout, building orientation and creation of buffer zones For water pollution: -A detailed drainage plan for the proposed neighbourhood -Measures to avoid pollution of existing watercourse

		during construction and operation of the neighbourhood (e.g. treatment of run-offs from hard surfaces; and water pollutants)
Environmental Impact Assessment	Reduce the impact of the neighbourhood on the environment	A detailed EIA report
Waste collection and management	Enhance adequate management of waste for a healthy environment	Waste management strategy showing among others: (i) An estimate of the amount of excavation waste (soil and stones) that would be generated and how the waste will be maximally reused during construction (ii) An estimate of other construction waste to be recycled (iii) Strategy for household waste collection e.g. method and frequency (iv) Strategy for household waste management e.g. estimate of household wastes to be recycled
Use of renewable energy systems	Reduce greenhouse emission and ensure non-depletion of the natural environment	Consideration for the possible use of renewable sources for power generation e.g. solar or wind
Provision of outdoor spaces	Enhance social interaction and conviviality	-Site plan of neighbourhood showing spaces for outdoor activities located close to each dwelling, block or streets
Security of lives and properties	To ensure that the lives and property of residents are safe	- Evidence of how the security of the neighbourhood is considered and addressed through design - Security plan and strategies for the neighbourhood when in operation
Neighbourhood square	create a central point for meeting in the neighbourhood	Site plan of proposed neighbourhood showing a centrally located neighbourhood square
Support for a home-based business	To support the local economy	-Economy study of how the proposed neighbourhood will contribute to the surrounding economy - Number of jobs that will be created locally during the neighbourhood construction - How proposed facilities and infrastructure such as

		transport, communication, and power among others will enhance home-based business in the neighbourhood.
Cost of construction, operation, and maintenance	Reduce the cost of repair and maintenance	An estimated breakdown of the total cost of construction; operation; and maintenance of the neighbourhood including the infrastructure and amenities of the proposed neighbourhood
Home affordability	Make the neighbourhood affordable to all and sundry	-Integrated distribution of various dwelling types to accommodate diverse income groups and users with no segregation -Friendly tenure housing systems e.g. rent, mortgage, or outright purchase
Efficient use of resources	Enhance the availability and non-depletion of resources needful for living	Water efficiency: an estimate of overall water consumption target for construction and daily use in a household Actions to minimise or not exceed consumption target e.g. landscape design options, water metering, and rainwater collection among others Energy efficiency: An energy strategy plan showing: -An estimate of the total energy demand of the neighbourhood -Design measures to reduce energy demand e.g. site layout and orientation, shading devices and solar orientation, daylighting and natural ventilation -Possibility of importing or exporting energy to existing or new neighbourhoods
Greenfield preservation	Prevent the destruction of greenfield areas characterised with deforestation, soil erosion and degradation	-Possibility of re-use of existing land to preserve greenfield areas -Site plan of proposed neighbourhood showing land use analysis in terms of buildable areas and green areas preserved

Effective land usage	Maximise the scarce commodity of land	-A detailed site plan showing how the site has been maximised and percentage of land for circulation -Design strategies to ensure effective land usage e.g. densification
Active frontages for commercial activities	Enhance shops and other retail outlets	- Provision of sales outlets attached to building units to encourage commercial activities
Use of locally-made material	Promote cultural values of the neighbourhood and local economy	-Percentage of construction that will be sourced locally
Aesthetics (public arts and landscape etc)	To enhance residents' experience and promote cultural heritage	- Neighbourhood design and elements such as colour, architectural style, building form to reflect the local context - Continuity of neighbourhood with existing development - Use of landscape elements for beautification
Home garden for food	Enhance subsistence food production	- Site plan of neighbourhood showing part of dwelling unit earmarked for food production

Source: Author, 2020

CHAPTER 3 RESEARCH METHODOLOGY

This chapter explains the methodology and justifies the appropriate methods undertaken to address the research question, aims and objectives, and deliver the desired research outputs. The purpose and value of critical realism as the philosophical stance adopted for this study are explained. The procedures for data collection and analysis are presented in subsequent sections followed by a review of the techniques for the validity and reliability of the research design.

In developing the research methodology, this study adopted the research onion developed by Saunders et al. (2016) as illustrated in figure 3.1 whereby the different layers of the model represent the various components which the methodology captures. This disciplined the research process and helped guard against arbitrary steps. For each of the components, this study attempts to weigh all the possibilities before making the most logical and appropriate decision. Each of the components of the onion as addressed is discussed hereafter.

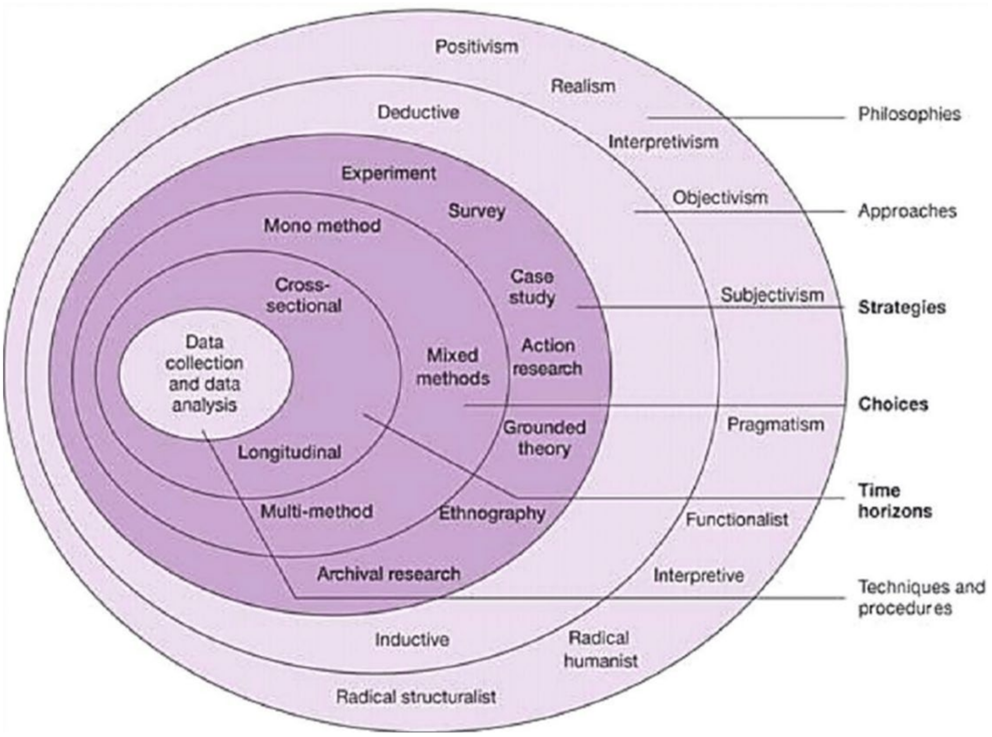

Figure 3. 1: Research Onion to develop research methodology
Source: Saunders et al. (2016)

3.1 Philosophy- Critical Realism

The need to capture stakeholders' understanding of a sustainable neighbourhood and establish their perception and preferences of its indicators in the context of metropolitan Lagos can be epistemologically and methodologically challenging. This is because, there is a need to establish and interpret the findings from the study in a way and manner that can be empirically grounded. As a result, several philosophical positions were considered which could be helpful in this study.

First was positivism which is based on the belief that there is an external reality which can be examined by independent value-free research (Coghlan and Brannick, 2005). According to Salama (2019b:10), it is exclusionary in nature because it results in "*supression of multiple viewpoints, thoughts and voices*". This philosophical position, therefore, seems inappropriate because gathering stakeholders' perceptions and understandings on a subject like sustainability deals with the acceptance and recognition of people's values and opinions (which makes it value-laden). Also, the highly objective nature of positivism and its quantitative approach (Easterby-Smith et al., 2012) further makes it not the most suitable, because this study would not only require numerical data but also textual data. For example, capturing the understanding of a sustainable neighbourhood will likely lead to subjective answers which are shaped by the people's peculiar perceptions.

Second was interpretivism which would have been appropriate because this philosophical position investigates perceptions and tries to find meanings to events in relation to a context (Fellows and Liu, 2009). In addition, it appreciates that the real world is complex and heterogeneous in nature with diverse views which need to be studied (Gray, 2014). Interpretivism is also inductive in nature because it involves generating new ideas based on emerging trends and patterns. However, despite these characteristics, interpretivism focuses on narratives and perceptions and does not proceed to establish the reasons and causes for the perception. If applied to this study, this philosophical stance would capture the understanding of stakeholders of a sustainable neighbourhood and their perceptions and preferences of sustainability indicators without further attempt to explore if these understandings are linked to existing reality or local context.

Three was post-modernism which attempts to focus on the deconstruction of texts to expose how values and interests are embedded in them (Gray, 2014). It assumes that knowledge can only be sourced through dominant ideologies. A postmodernist in the context of this study will be of the view that sustainability indicators can only be identified by experts and that non-experts' opinions are not important.

Four was social constructivism, which is a sociological theory that argues that human development is socially situated and that knowledge is constructed through interaction with others (McKinley, 2015). In this instance, it means that peoples' understandings and perceptions will be shaped by what is acceptable based on the general belief system. This was also found to be inappropriate as it will not attempt to explore the perceptions based on reality but on social norms.

Five was critical realism which offers an explanatory linkage that integrates the people's understanding in relation to their context (Archer, 2002; Fletcher, 2017). Critical realism which emerged in the closing decades of the 20th century and further espoused by critical realists like Archer et al. (1998) and Archer (2002) starts from the opinion that the picture that science paints of the world is true and accurate (Chia, 2003). As a philosophical position, critical realism tends to seek for a deeper understanding of our observation and experience in relation to the surrounding context that shapes the event (Easterby-Smith et al., 2012). It has similar characteristics with the emancipationist stance posited by Salama (2019), which argues that realities are shaped by varieties of contextual values including social, cultural, ethnic, and political aspects amongst others.

Table 3.1 provides a summary of the comparison of the four philosophical positions considered for this study in terms of their characteristics.

Table 3.1: Comparison of the four philosophical positions

Philosophical stances	Ontology	Epistemology	Axiology	Typical methods
Positivism	real, external, independence; and ordered	scientific method and discovery of universal laws and principles; casual explanation and prediction; knowledge is objectively verifiable	value-free research; an objective stance	deductive, quantitative methods of analysis
Critical realism (adopted)	stratified and layered; multiple realities based on objective values	epistemological relativism; facts and causal analysis	value-laden research	range of methods and data types to suit the subject matter
Interpretivism	complex and rich; socially constructed through culture and language	theories and concept too simplistic; focus on narratives, stories, perceptions and interpretations	value-bound research; the researcher's interpretation is key	inductive; in-depth investigations; qualitative methods of analysis
Postmodernism	Nominal; socially constructed through power relations	truth and knowledge are decided by dominant ideologies	value-constituted research;	deconstructive; in-depth investigations on anomalies

Source: Author, 2020

Appropriateness of Critical Realism

The elements of critical realism can be highlighted under three main themes.

- One is in terms of ontology where it is stratified and layered. This means it accommodates various layers (or strata) of views and perceptions on a subject.
- Two is epistemology where it is characterised with facts and causal analysis. That is, our knowledge of a subject is most times influenced by reality and some underlining factors which are peculiar to that context.
- Three is axiology where it is value-laden. As a result of its ontology and epistemology positions, it is influenced by people's values, opinions, and aspirations as well.

Based on this premise, critical realism is appropriate for the study on the following justifications. Firstly, one of the study objectives is to establish the various understandings and perceptions of a sustainable neighbourhood from the relevant stakeholders. This aligns with the ontological position of critical realism which involves going beyond the global standards or perceptions of the sustainable neighbourhood concept, but to know how it is understood in the context of metropolitan Lagos. This would allow the synthesis of the various perceptions of the concept. Secondly, the epistemological characteristics of critical realism are suitable for this study which would attempt to know how the context of metropolitan Lagos shape stakeholders' answers, and to what extent the daily reality seems to affect their understanding of a sustainable neighbourhood and the characteristics of the indicators that define it. Thirdly, the value-laden nature of critical realism is well suited for this study which seeks to establish how the values, needs, and aspiration of stakeholders influence their understanding of a sustainable neighbourhood and its indicators.

3.2 Research Approach - Inductive and Deductive

This study conducted both inductive and deductive analysis to address the research aim and question. The inductive analysis involves generating new inferences which involved extrapolation of the trajectory of thinking from the emerging data (Bernard, 2011; Saunders et al., 2012). In this study, through inductive analysis, responses from stakeholders were organised into similar themes, so that clarity in the key categories of ideas could emerge to inform what defines the concept, or how it is conceived in metropolitan Lagos. An inductive approach was also used in exploring the patterns in perception across the various stakeholders based on their demographic or professional affiliations. This was done by correlating the various themes that emerged to each of the categories of the institutional stakeholders and the residents as well through their affiliations and demographic characteristics respectively. For example, the dominant theme among the regulators or developers (in the category of institutional stakeholders) can be established while also identifying any similarity and difference in their perceptions.

The deductive analysis which involves statistical testing of theory was conducted for the quantitative data obtained from the questionnaires. This focused on establishing statistically the importance of the pre-identified indicators among a list of others. To this end, the result from the questionnaire was analysed using descriptive statistics where the Weighted Averages (WA), Co-efficient of Variation (CV), and Content Validity Ratio (CVR) were calculated. This was helpful to enhance the reliability and robustness of the key findings. The result from the AHP questionnaire which captured the stakeholders' preferences would further help to determine and confirm the rank and priorities of the indicators in the decision-making process. These findings were further used in exploring the characteristics of the indicator set which is the main question that this study seeks to address.

3.3 Mixed Method Approach

The choice of a research method within the three research methods of quantitative, qualitative, and combination of both (mixed-method) depends on the nature of the research question and the type of data (numerical, textural, or both) to be collected to address the research question (Williams, 2007). The quantitative approach is used for research questions requiring numeric data which are analysed using statistics, while qualitative approach requires thematic analysis using textual data (Punch, 2009; Creswell, 2014). The mixed-method research applies both numerical and textual data (Thomas, 2003).

In this study, the need to establish the stakeholders' understanding of a sustainable neighbourhood which will be textual leading to themes being generated, is qualitative in approach. However, because this study also intends to robustly establish statistically rankings of perceptions, this also led to the use of a quantitative approach. This study is therefore based on a mixed-method approach which has the advantage of combining the strengths from either of the qualitative and quantitative approaches. In addition, mixed-methods also ensures the following: one, completeness in terms of getting a range of interpretations from both textual and numerical data; two, to help deepen the understanding of a situation which could lead to generation of new theory; three, confirmation from either qualitative or quantitative as the case may be to reinforce the findings; and four, reduction in bias that may be associated to one method (McEvoy and Richards, 2006; Teddlie and Tashakkori, 2009).

Creswell and Clark (2011) identified the following six types of mixed-method research approaches: (i) convergent parallel where the researcher gathers both quantitative and qualitative data, analyses both separately, and compares the results to know if there is any contradiction; (ii) explanatory sequential where quantitative data is first collected, followed by qualitative data to gain a deeper understanding of the quantitative data which only provides a general picture of the phenomenon; (iii) exploratory sequential where researcher first collects qualitative data to explore a phenomenon, followed by collection of quantitative data to explain the relationship in the qualitative data; (iv) embedded where quantitative and qualitative data are collected simultaneously or sequentially, in which the second form of data plays a supportive role to the first (Creswell and Clark, 2011). In this instance, a single data set from one approach is not enough as combining two approaches provides a better understanding of research problems than when one approach is used (either quantitative or qualitative); (v) transformative where the researcher using any of the four discussed methods (that is, convergent parallel, explanatory, exploratory, and embedded) fits the study to a transformative (a problem-saving) framework with the intention to address a social issue that will bring about change (ibid); (vi) multiphase which is like the transformative mixed-method. The difference is the fact that the research problem is addressed in phases or in separate studies.

To address the focus of this study, the embedded and the convergent mixed-methods were adopted as presented in table 3.2 combining the qualities of two mixed-methods approaches (Teddlie and Tashakkori, 2009). The embedded element was applied to establish stakeholders' perceptions of sustainability indicators through statistical computations which are quantitative. In addition, respondents were asked to suggest indicators that they felt were omitted in a qualitative approach. The convergent element was then applied later to combine the results from: (i) the stakeholders' understanding of a sustainable neighbourhood; and (ii) stakeholders' perceptions and preferences of sustainability indicators.

A similar approach was adopted by Kong et al., (2016) where a convergent and embedded mixed-method research approaches were used to explore the design of architectural intervention, and to determine its effectiveness in improving environmental knowledge, attitudes, and behaviour among students.

Table 3. 2: How the methods address research objectives and expected findings

Research objectives	Methodological approach /technique	Expected output
Identifying generic sustainability indicators at the neighbourhood level from literature	Qualitative/Literature review	Pre-selected list of sustainability indicators
Exploring stakeholders' understanding of the concept of a sustainable neighbourhood in metropolitan Lagos	Qualitative/ Questionnaire	Sustainability themes and aspects
Establishing the indicators of a decision-making framework for metropolitan Lagos as influenced by the context-specific perceptions and preferences of stakeholders	Quantitative and Qualitative/ Questionnaire (CV, CVR, AHP)	Ordering, weighting, and ranking of sustainability indicators for neighbourhood suitable for metropolitan Lagos according to importance to stakeholders
Validating the developed indicators by testing their potential usability and adoptability, whilst identifying the likely barriers of their uptake for decision-making;	Quantitative and Qualitative/Questionnaire	An evidence-based tested and accepted indicator set
Establishing how contextual factors of Lagos influences characteristics of the selected indicators	Quantitative and Qualitative	Characteristics of the indicator set as shaped by the context

Source: Author, 2020

3.4 Research Strategy - Survey

Research strategy can be defined as a plan that a researcher intends to follow in answering a research question (Saunders et al., 2016; Johannesson and Perjons, 2014). It bridges the research philosophy and the methods for data collection and analysis (Denzin and Lincoln, 2011). The success of the strategy adopted by a researcher is a function of the research methods that guide the study. The choice of a research strategy according to Johannesson and Perjons (2014) depends on: suitability with respect to the research question; feasibility taking into cognisance the resources that have been allocated for the project; and ethical consideration in terms of its possible effect on people, animals, and the environment. Some common types of research strategies according to Denscombe (2007); Collis and Hussey (2009); and Saunders et al (2016) include: (i) Survey; (ii) Case study; (iii) Experiments; (iv) Ethnography; and (v) Grounded theory.

In this study, survey research was adopted as a strategy that involves the collection of information through responses to questions from a sample of individuals (Check and Schutt, 2011). Surveys are best used for gathering data on narrow and well-defined topics (Johannesson and Perjons, 2014). It is one of the most widely-used strategies because of its versatility, efficiency, and generalisability. For example, many variables can be measured without necessarily increasing the cost and time. In addition, data can be collected from as many people as possible at a low cost. As a research strategy, the survey allows various methods of data collection such as questionnaires, interviews, document and observation amongst others. Denscombe (2007) identified postal questionnaires; internet survey; face-to-face interviews; telephone interviews; documents; and observations as the various types of surveys.

This strategy is appropriate for this study because stakeholders' understanding of a sustainable neighbourhood in metropolitan Lagos, and their perception and preferences of sustainability indicators, can be captured through responses to questions presented in a survey.

The choice of the survey research strategy was after careful review of other research strategies and their limitations with respect to this study. Case study strategy would have been appropriate for this study if the focus is on Sub-Sahara Africa (SSA), and the study intends to draw comparisons and relationships by examining various SSA cities. This is because, case study focuses on one instance (a case) of a phenomenon to study, and analyse events, relationships, experiences or processes, in great depth, thereby offering a rich description and insight of that phenomenon (Denscombe, 2007; Sake, 2000; Creswell, 2003; Yin, 2009; Johannesson and Perjons, 2014). Also, experimentation is inappropriate as this study does not intend to investigate the causal relationships between two variables in a controlled environment which is the main characteristic of this strategy (Johannesson and Perjons, 2014), but instead, to explore the perception of stakeholders on variables (sustainability indicators) in relation to their context. Also, in experimentation, the researcher has control over what is to be studied where there is manipulation of the independent variable and subsequent effect on the dependent variable (Collis and Hussey, 2009). However, this study explores a phenomenon based on the personal opinions of the participants.

Furthermore, ethnography in the context of this study would imply a study of the culture of residents in urban neighbourhoods (Leedy and Ormord, 2001) which is not what this research attempts to address. Lastly is grounded theory, which focuses on developing theory from empirical data obtained from the interaction grounded in the view of participants in a study (Johannesson and Perjons, 2014; Creswell, 2003), is also not suitable, because this study is structured on some existing theories and knowledge like: context-specificity of sustainability; decision-making theory; and the critical role of the neighbourhood scale in shaping urban places.

3.5 Role of Perceptions and Preferences

The subjectivity of sustainability has necessitated the need for stakeholder engagement in developing the indicator set of an assessment framework (Bell and Morse, 2003). This is essential as people have different perceptions of sustainability and preferences based on their needs and aspirations which are driven by an underlying context.

Perception in this study refers to the ways in which stakeholders interpret and understand the concept of sustainability as it applies to their neighbourhoods. Because this is a concept that is not easy to grasp, indicators become a useful proxy, to obtain stakeholders' judgement about aspects of a sustainable neighbourhood that they value. By deciding amongst a set of given indicators, it is hoped that the judgment captured through stakeholders' perceptions would help to select the important indicators in planning for a sustainable neighbourhood in metropolitan Lagos.

In methodological terms, preference in this study refers to how stakeholders prioritise the indicators in relation to each other. That is, which of the indicators when compared to another one should be given priority in the decision-making process in planning for a sustainable neighbourhood. The result of the stakeholders' preference captured using the Analytical Hierarchy Process (AHP) was helpful to assign weight and to rank the indicators.

The essence of capturing perception and preferences of stakeholders in sustainability discourse is of great importance as earlier discussed in section 2.7.6 under the roles of stakeholders. This further justifies the adoption of the critical realism philosophical stance, because it brings local connections and linkages so that the research findings can be analysed and connected with a more practical understanding.

3.6 Data Collection

This study made use of questionnaire as a method for data collection which according to De Vaus (2001) comprises of series of questions designed for gathering information from respondents. According to Denscombe (2007), questionnaire based on structure and type of question can be: (i) structured with close-ended questions; (ii) semi-structured with both closed-ended and open-ended questions; and (iii) unstructured with open-ended questions. On the mode of completion, it can be classified as either self-completed or researcher-completed.

In this study, the semi-structured type of questionnaire with both closed-ended and open-ended questions was adopted to capture both quantitative and qualitative data respectively. Although the questionnaire administered face to face was initially designed to be self-completed, the field assistants helped respondents who could not complete the questionnaire on their own. The field assistants were adequately briefed on how to go about this task. Three different questionnaires A, B, and C were designed and administered based on: (i) the different groups of participants for this study and (ii) the research objectives to be addressed (Table 3.3).

Table 3. 3: Questionnaires designed to address research objectives

Questionnaires	Research objectives	Respondents
A	Exploring stakeholders' understanding of the concept of a sustainable neighbourhood in metropolitan Lagos	Institutional stakeholders and residents
B	Establishing the indicators of a decision-making framework for metropolitan Lagos as influenced by the context-specific perceptions and preferences of stakeholders	
C	Validate the developed indicators	Institutional stakeholders

Source: Author, 2020

Sampling Technique

It is noteworthy that the survey strategy adopted for this study lends itself to sampling because it will be a daunting task to collect data from everyone in the large population. Sampling according to (Babbie, 2010) is the procedure of selecting units of observation which can be generalised to a larger population. This could either be probabilistic sampling when the researcher has an idea, that there is a probability that each element in the population will be a representative cross-section of people in the population being studied; or non-probabilistic when the researcher does not have such notion or idea.

The various sampling technique adopted for this study is explained in this section as presented in table 3.4 and further discussed.

Table 3.4: The sampling techniques adopted for the study

Sampling techniques	Application in study
Probabilistic	
Random	To identify participants who subsequently nominated others
	To identify participants from a pool of academics
Stratified	To divide the neighbourhoods into various strata ensuring a holistic coverage of the population
Systematic	To identify participants from each of the strata
Non-Probabilistic	
Snowball	To identify other participants in the built environment professionals

Source: Author, 2020

3.6.1 Questionnaire A- Stakeholders' Perceptions

This questionnaire was administered to both institutional stakeholders and residents as further explained:

(I) Institutional Stakeholders

The questionnaire (appendix 3.5) was administered to the three categories of institutional stakeholders:

(i) Developers: Private or government institutions responsible for delivering neighbourhoods which include Ministry of Housing (MoH); Lagos State Building Investment Company (LBIC); and Lagos State Development and Property Corporation (LSDPC).

(ii) Regulators: Government institutions responsible for ensuring that neighbourhood development in metropolitan Lagos adheres to the physical planning regulations which include Ministry of Physical Planning and Urban Development (MPPUD); Lagos State Building Control Agency (LBCA); Lagos

State Physical Planning and Development Authority (LASPPDA); and the New Town Development Authority (NTDA).

(iii) Built environment professionals: Individual practitioners (staffs) in government ministries and agencies responsible for neighbourhood development and regulation in metropolitan Lagos; and academia who have written extensively on neighbourhood planning in the context of metropolitan Lagos

This questionnaire was structured into three parts. The first part sought background information of the respondents including their professional experience and role in neighbourhood planning and delivery in metropolitan Lagos. This was to determine if the background factors influence respondents' perceptions. The second part addressed research objective 2, to explore stakeholders' understanding of a sustainable neighbourhood concept. Participants were asked to define the term ''sustainable neighbourhood''. The third part addressed research objective 3, which is to gather the indicators that can be useful in assessing a sustainable neighbourhood. They were also asked to add other indicators that they felt were omitted. Participants' perceptions were obtained using a 5-point Likert scale of importance (Figure 3.2).

1- Not important and dispensable
2- Little importance but contribute insignificantly
3- Important but only contributes slightly
4- Important and contributes significantly
5- Highly important and indispensable

Figure 3. 2: The 5-point Likert scale of importance

Participants identified in the category of the 'regulators' and 'developers' were based on nomination by the each of the ministries and agencies, because they were to serve as a voice for their respective institutions (tables 3.5 and 3.6). To achieve this, a letter was sent ahead to the institutions to make a nomination (appendix 3.2). These are organised ministry and agencies where a participant from each one is enough. Also, two private real estate companies were contacted to make nominations.

Table 3. 5: Stakeholders in the regulatory ministries and agencies

Regulatory institutions and anonymised name	**Questionnaires administered**	**Questionnaires retrieved**
Ministry of Physical Planning and Urban Development (MPPUD)	1	1
Lagos State Building Control Agency (LASBCA)	1	1
Lagos State Physical Planning and Development Authority (LASPPDA)	1	1
New Town Development Authority (NTDA)	1	1
Total	4	4
Response rate	100%	

Source: Author, 2020

Table 3. 6: Stakeholders responsible for neighbourhood development in metropolitan Lagos

Institutions responsible for the development and anonymised name	**Questionnaires administered**	**Questionnaires retrieved**
Ministry of Housing (MoH)	1	1
Lagos State Development and Property corporation (LSDPC)	1	1
Lagos Building Investment Company (LBIC)	1	1
Private Developer (PDEV1)	1	1
Private Developer (PDEV2)	1	1
Total	5	5
Response rate	100%	

Source: Author, 2020

Participants identified in the category of the built environment professionals are either staffs of government ministries and agencies; or academia (Table 3.7). The selection of participants in government ministries and agencies was conducted through random and snowball sampling techniques. A participant in each of the ministries was picked randomly, who subsequently suggested other prospective participants who will be willing to participate in the survey (in what is known as snowball). The random sampling was conducted by assigning a number to each of the staffs in the ministries visited. These numbers were written on folded different sheets of papers depending on the number of staffs. The folded papers were then all gathered in a pool from which one paper was selected randomly (representing the staff to contact), with each of the papers having an equal chance of being picked. In the same approach, participants from the academia were identified using the random sampling from the pool of academics (who are also built environment professionals) who have written extensively on neighbourhood planning in metropolitan Lagos.

Table 3. 7: Stakeholders from the built environment profession

Profession	**Institutional affiliation**	**Questionnaires administered**	**Questionnaire retrieved**
Town Planner	New Town Development Authority (3 Nos)	3	3
Builder	Ministry of Housing Architecture and Building (1 No)	3	2
Civil Engineer	Engineering (3 Nos)	3	1
Quantity Surveyor	Quantity Surveying (3 No)	3	1
Town Planner	Lagos State Building Control Agency	3	2
Architect/Academia	Obafemi Awolowo University, Nigeria	1	1
Architect/Academia	Obafemi Awolowo University, Nigeria	1	1
Architect/Academia	University of New South Wales, Australia	1	1
Total		18	12
Response rate		66.67%	

Source: Author, 2020

(II) Residents

Questionnaire A was further administered to residents (appendix 3.6). In this case, background information of residents like gender, marital status, educational status, age, occupational status, and income group was captured instead of professional affiliations, and years of experience in the one administered to institutional stakeholders. Also, in the second part, instead of asking the residents to define or explain the term ‘sustainable neighbourhood’, they were asked to highlight key components in a neighbourhood that they would like to live, work, and enjoy a good quality of life. This was premised on Roberts (2009) and ODPM (2004) as what defines a sustainable neighbourhood.

Using the same 5-point scale, the third part explored the perception of the residents on the importance of the sustainability indicators that define a sustainable neighbourhood. Respondents were also asked to suggest other new indicators that they felt should be included. Because this study could not possibly access all neighbourhoods in metropolitan Lagos due to resources and time, the questionnaires were administered in three neighbourhoods which are of the master-planned neighbourhood development in metropolitan Lagos.

As a selection criteria, the study ensured that one neighbourhood each was identified from the three main developers in metropolitan Lagos. These are Federal Government, State Government, and Private developers. As a result, the following neighbourhoods were selected.

One is Gowon Estate (named after the then Head of State in Nigeria) and hereinafter reffered to as Neighbourhood A. The housing estate was built in 1977 to host visitors during the Festival of Arts and Culture (FESTAC) hosted by Nigeria. After the event, it was sold outrightly to civil servants through a ballot. However, some sections of the neighbourhood were reserved for defence staffs (naval, custom, and air force) and Union Bank. The neighbourhood has a central sewage system, good electricity supply, a central market, and corner shops which are approved by the Federal Housing Authority (FHA) who is responsible for its administration. The challenges with the neighbourhood include poor maintenance of infrastructure; shortage of water supply which has made individual residents have their individual borehole. There is also no government hospital.

Two is Abesan Estate delivered by the State government (hereafter referred to as Neighbourhood B). Built by Governor Lateef Jakande between 1981 and 1982, the development was targeted at citizens in the low- and medium-income groups. Administratively, it is divided into two wards (Abesan 1 and 2). In addition to houses built by the government, there are also some piecemeal developments in the neighbourhood. In terms of infrastructure, it has 1 government secondary school, 1 government primary school, 12 private secondary schools, a central market, churches and mosques, small scale industries (e.g. dry-cleaning services, soap making, bakery, repair workshops, fashion designing, restaurants, and pubs etc), and 1 government hospital but a few private medical facilities. Though not purpose-built, it is noteworthy that 75 per cent of the buildings have small shops attached to their frontage. Waste is collected thrice a week in the neighbourhood by the Lagos Waste Management Authority (LAWMA). Although the neighbourhood does not have a police station, there are neighbourhood corps. In addition to this, each sector has a private arrangement for security. The challenges in the neighbourhood include erratic power supply of only 8 hours of access per day. Only 20 per cent of households are serviced by the waterworks with 80 per cent made to be responsible for their water supply. Also is the inability to maintain infrastructure as evident in the central sewage that is no longer functioning which has led to a situation where each block relies on a septic tank which is disposed of once in two years. There is also a complaint of noise pollution within the estate created by street hawkers. However, there is also a central fire station which is yet to be commissioned.

Three is Rose Garden Estate delivered by a private institution (hereafter referred to as Neighbourhood C). Built in 2002, Rose Garden estate is currently managed by a private developer. It is a smaller neighbourhood in comparison to Neighbourhoods A and B. It is mostly occupied by middle-income earners. Since it is a small neighbourhood, there is no major infrastructure in the neighbourhood because it relies on adjoining and existing neighbourhoods. Residents are charged monthly for waste collected by LAWMA. Each household is supplied with water which is unlike other neighbourhoods in this study. The neighbourhood arranged for security and gardening. It is noteworthy that there is an internal administrative framework under the Rose Garden Estate Residents' Association (ROGERA).

The questionnaire was administered in these neighbourhoods using both stratified and systematic sampling techniques. As a result, the population in each of the neighbourhood were divided into strata based on the design typologies where they live. Systematic sampling was further adopted in each of the strata. The questionnaires were completed and retrieved on the field. However, few of the residents declined which this study noted as though administered but not retrieved.

Neighbourhood A

The stratified sampling adopted in this neighbourhood was influenced by the four major design typologies in the neighbourhood to ensure that each of the typologies was covered. Using the systematic sampling, one questionnaire was administered in every 5th block in each typology. The '3-storey block of 16 units of 2-bedroom flat' is the dominant typology reason for having the highest number of questionnaires administered. This was followed by the '3-storey block of 8 units of 3-bedroom flat' (Table 3.8).

Table 3. 8: Questionnaire retrieved in Neighbourhood A

Design typologies (Strata)	**Questionnaires administered (in every 5th block)**	**Questionnaires retrieved**
4-storey block of 16 units of 2 bedroom flat	65	57
4-storey block of 8 units of 3 bedroom flat	51	43
A row of 2-bedroom bungalow with courtyard	35	25
A row of 3-bedroom flat duplexes	32	25
Total	183	150
Response rate	81.97%	

Source: Author, 2020

Neighbourhood B

The questionnaires in neighbourhood B were administered using the sectoral divisions of the neighbourhood (stratified sampling). A sector comprises usually of between 15 to 22 blocks (buildings). A block is a 2-storey building of 6 units of 3-bedroom flats. This study ensured that each sector was represented in the sample size (Table 3.9). Using systematic sampling, 6 questionnaires were administered in each of sectors. In sectors 1 to 25 with have an average of 18 blocks per sector, a questionnaire was administered in every 3rd block. In sectors 26 to 30 which has an average of about 24 blocks per sector, a questionnaire was administered in every 4th block. In sectors 31 to 33 with an average of 12 blocks per sector, a questionnaire was administered in every 2nd block.

Table 3. 9: Questionnaire retrieved in Neighbourhood B

Sectors	**Average number of blocks per sector**	**Questionnaires administered per sector**	**Total questionnaire**	**Questionnaires retrieved**
1-25	18	6	150	100
26-30	24	6	30	30
31-33	12	6	18	9
Total			198	139
Response rate			70.2%	

Source: Author, 2020

Neighbourhood C

The questionnaires were administered in neighbourhood C using the 14 blocks that make up the neighbourhoods. A block consists of 4 flats, where 2 questionnaires were administered (Table 3.10).

Table 3. 10: Questionnaire retrieved in Neighbourhood C

Blocks	**Questionnaire administered per block**	**Total questionnaire**	**Questionnaires retrieved**
A-N	2	28	20
Response rate		71.43%	

Source: Author, 2020

3.6.2 Questionnaire B - Stakeholders' Preferences (AHP)

This questionnaire (appendix 3.7) sought to capture stakeholders' preferences of identified indicators in order to rank them accordingly. This was conducted in a pair-wise comparison using the Analytical Hierarchy Process (AHP), where the sustainability indicators were arranged under the different dimensions that they can best be described (that is, environmental, social-cultural, and economic). The AHP methodology was adopted because it is helpful in determining the priorities of various alternatives which has the potential to aid the decision-making processes. Developed by Thomas L. Saaty in the 1970s, it is a widely used technique to determine the relative weight of multiple criteria or options against a given parameter (Saaty and Peniwati, 2008). AHP can be used for the following decision instances: choice; ranking; weight; prioritisation; resource allocation; benchmarking; quality management; and conflict resolution (Forman and Saul, 2001). To this end, it has found wide applications in business, healthcare, and industry among others (Yang et al., 2000; and Yurdakul, 2004).

The AHP procedure is in three stages. First is to structure a decision problem and identify the indicators spelling out the goal and clearly establishing the challenge to be addressed. The second step is the priority setting of sustainability indicators by pairwise comparison. Subsequently, the weights are normalised and averaged to obtain the average weight of each criterion. Lastly is the consistency ratio (CR) which is used to determine the coherence of responses in order to eliminate inconsistent results (Wong and Li, 2008). The value of the consistency ratio which depends on the matrix size helps to validate the results from the AHP. In a 3 X 3 matrix, it must not exceed 5 per cent; 8 per cent for a 4 X 4 matrix, and 10 per cent for a larger matrix size (Saaty and Vargas, 2013).

Participants were firstly asked to compare in pairs the dimensions (environmental, socio-cultural, and economic) with each other, and later the indicators under each sustainability dimension. For instance, they were required to respond to a question such as: “How important is the environmental dimension relative to the economic dimension in contributing to a sustainable neighbourhood? This preference was obtained using the 9-point scale between 1 (representing equal importance) and 9 (representing extreme importance). However, the reciprocal of value was assigned to the other dimension or indicator that is paired with. Figure 3.3 shows the 9-point scale.

1- Equal importance of both elements
3- Moderate importance of first element over the second
1/3 (0.33) - Moderate importance of second element over the first
5- Strong importance of first element over the second
1/5 (0.20) - Strong importance of second element over the first
7- Very strong importance of first element over the second
1/7 (0.14) - Very strong importance of second element over the first
9- Extreme importance of first element over the second
1/9 (0.11) - Extreme importance of second element over the first
2,4,6,8- Intermediate values

Figure 3. 3: The 9-point scale for AHP pairwise comparison

AHP has the following advantages: One, it allows checking for inconsistencies in results obtained (Ramanathan, 2001). Two, addresses the decision-making challenge by decomposing it to its constituent parts and then building hierarchies of criteria (Macharis et al., 2004). Three, supports group decision-making by calculating the average weight of each variable from which they can be ranked, and their level of importance known (Zahir, 1999). However, the major disadvantage of AHP is that a very large number of pair-wise comparisons may need to be conducted, therefore becoming a lengthy and onerous task (Macharis et al., 2004). In addition, it may result in a high inconsistency ratio. This was addressed in this study by not having repetitive indicators which only constitute ‘noise’ in the system. Also, only the indicators under the same sustainability dimensions were compared to each other. This helped to reduce the number of pair-wise comparisons that would have been conducted.

The participants for this phase were those who volunteered that they were still interested in the next stage after completing questionnaires A and B. However, new participants were also included in the pair-wise comparison to achieve an acceptable sample size. Because inconsistency in an AHP may invalidate the result, in addition to the patience required in completing the questionnaire, a minimum of 5 respondents was targeted for each group (table 3.11). This is to increase the possibility of having a more consistent result and to accommodate for questionnaires that would not be returned by respondents. Consequently, a total of 50 questionnaires were administered, out of which 29 AHP questionnaires were retrieved giving a response rate of 58 per cent which is acceptable.

The highest numbers of questionnaires were administered in the category of public developers (that is, Ministry of Housing; Lagos State Development and Property Corporation; and Lagos Building Investment Company) because they are the main channels for neighbourhood development in metropolitan Lagos. A huge percentage of neighbourhood developments are a product of the activities of public institutions covering all socio-economic status. The identity of the respondents was anonymised for confidentiality.

Table 3. 11: Participants for AHP Questionnaire

Category of respondents	**Questionnaire administered**	**Questionnaire retrieved**	**No of valid questionnaires**	**Anonymised name**
Residents Neighbourhood A Neighbourhood B Neighbourhood C	 5 5 5	 2 3 1	 1 2 1	 Participant_1 Participant_2 Participant_3 Participant _4
Private developers	5	4	3	Participant_5 Participant_6 Participant_7
Ministry of Housing Architecture and Building services Quantity Surveying Engineering Town Planning	 5 5 5 5	 5 2 2 5	 4 1 2 4	 Participant_8 Participant_9 Participant_10 Participant_11 Participant_12 Participant_13 Participant_14 Participant_15 Participant_16 Participant_17 Participant_18
Lagos State Property Development Corporation	5	2	2	Participant_19 Participant_20
Lagos State Building Investment Company	5	3	1	Participant_21
Total	50	29	21	
Response rate	58%			

Source: Author, 2020

3.6.3 Questionnaire C - Validation of Indicator Set

This questionnaire (appendix 3.7) sought to deliver research objective four which is to validate the developed indicators through questionnaires in terms of its usability, and the uptake of the indicators in the decision-making process of new neighbourhoods in metropolitan Lagos. The term ‘validation’ according to the Oxford dictionary is the action of “checking or proving the validity or accuracy of something” or “making or declaring something legally or officially acceptable”. In relation to an indicator, it is validated if it is scientifically designed, supplies relevant communication, and it is useful to targeted users.

The validation of an indicator set can be of three types (Bockstaller and Girardin, 2003). One is design validation which assesses the content and structure of the indicator set to know if it is scientifically founded. Two is the output validation which is also known as the credibility evaluation as it relates to the degree of confidence that the potential end-users have in the indicator set (Meul et al., 2009). Three is the end-use validation which seeks to know if the indicator set aids decision-making, and the willingness of the end-users to use the indicator set in the real world.

In this study, the design validation would assess the content of the indicator set, and the weight of each indicator. The end-use validation would assess if the indicator set is useful for decision-making in prioritising indicators. It attempts to establish whether the indicator set is what can be used in the day-to-day practise or not; the likely barriers for the uptake; and how the barriers can be addressed.

The questionnaire was structured into 3 parts. The first part captured the background information of participants. The second part addressed the design validation of the indicator set in terms of: (i) its comprehensiveness to address sustainability at the neighbourhood level in metropolitan Lagos; and (ii) the ranking of the indicators. The third part addressed the end-use validation where stakeholders' perceptions on the criticality level of some barriers for the uptake of the indicators using a 5-point scale (1- not critical; 2- less critical; 3- neutral; 4- critical; 5- very critical) were established.

The targeted participants for the validation were primarily the likely users of the indicators to enhance the decision-making process of a new neighbourhood. These are the institutions (either government or private) responsible for developing new neighbourhoods in metropolitan Lagos, and those responsible for regulating such development. The same respondents for 'questionnaire A' that served as the voice for these institutions were contacted for the validation of the indicators. The two private developers also participated (Table 3.12).

Table 3. 12: Respondents for validation of the indicators

Institutions	**Questionnaires administered and retrieved**
Ministry of Physical Planning and Urban Development (MPPUD)	1
Ministry of Works (MoW)	1
Lagos State Building Control Agency (LASBCA)	1
Lagos State Physical Planning and Development Authority (LASPPDA)	1
New Town Development Authority (NTDA)	1
Ministry of Housing (MoH)	1
Lagos State Development and Property Corporation (LSDPC)	1
Lagos Building Investment Company (LBIC)	1
Private Developer (PDEV1)	1
Private Developer (PDEV2)	1

Source: Author, 2020

3.7 Data Analysis

Both qualitative and quantitative approaches to data analysis were undertaken. The qualitative data obtained from the questionnaires sought to establish a contextual understanding of the idea of a sustainable neighbourhood was analysed thematically. Braun and Clarke (2008:79) defined thematic analysis as “a method of identifying, analysing, and reporting patterns (themes) within data”. It involves a coding, and categorising the patterns in the data (Patton, 2015; Leedy and Ormrod, 2001). This is to understand how the various patterns and themes are distributed. Thematic analysis was used to analyse the various meanings and definitions of a sustainable neighbourhood to know the keywords and ideas that are dominant. The NVivo software was used to analyse the stakeholders' understandings of a sustainable neighbourhood. This is because the software helps the user to organise and assign large amounts of qualitative data to the various themes (or nodes) which best describe them in a faster, easier, and more efficient manner (QSR, 2019). The software was also useful to analyse the data from the validation phase of the indicator set.

The quantitative data obtained from the questionnaires A and C were analysed by the Microsoft Excel functions using descriptive statistics such as frequency, weighted average (WA), variance (V), and standard deviation (SD). For example, the frequency of a sustainability indicator shows the level of importance or non-importance on the rating scale.

The WA value of an indicator helps to know the various levels of importance attached to an indicator by the stakeholders on a scale of 1-5. For example, a weighted average of 4.5 shows a high level of importance attached to it by stakeholders when compared to a weighted average value of 3.0. This information was used to build a shred of empirical evidence in selecting from the indicator set the appropriate ones for metropolitan Lagos based on stakeholders' perception. The WA was also useful to understand the stakeholders' agreement on the comprehensiveness, ranking, and adoptability of the indicator set at the validation phase.

The weighted average was calculated by: (i) multiplying the number of respondents that selected each rating for a dimension by the corresponding rating value; (ii) summing up the result of (i); and (iii) dividing the sum by the total number of respondents.

Besides the weighted average (WA), the coefficient of variation (CV) and content validity ratio (CVR) were calculated. The coefficient of variation is the ratio of the standard deviation to the rating average.

That is, CV = (standard deviation) / (weighted average).

The standard deviation is the amount of dispersion of a set of data values. In the context of this study, it means how individual perception varies from the average group perception. For instance, an indicator with a standard deviation close to zero shows that the perceptions of the respondents are close to one another. However, a high standard deviation shows a wide variation in the perception of individuals compared to the group perception. Co-efficient of variation (CV), also known as the relative standard deviation shows the extent of variability to the mean. This implies in this study that, an indicator with a small CV value shows a high level of agreement among stakeholders. According to Wilson et al. (2012) and Lawshe (1975), an indicator with a CV value less than 0.5 can be said to be consensually agreed upon by the stakeholders This supports the result from the WA to further help to empirically determine which indicators should be selected.

The content validity ratio (CVR) of an indicator helps to know how essential or non-essential it is in the decision-making process of a new neighbourhood. This is another approach in addition to the WA and CV to select the appropriate indicators for metropolitan Lagos from the pre-selected list. An indicator is essential in the decision-making process if the CVR is at least 0.29.

It can be calculated using this formula:

CVR= (NE-N/2) / (N/2)

N= the number of respondents indicating that a dimension is ‘important’ and ‘very important’.

NE= total number of respondents

According to Lawshe (1975), the CVR values range from -1 (perfect disagreement) to +1 (perfect agreement). Values above zero indicate that over half of the respondents agree that a variable is essential (Ayre and Scally, 2013). It can be deduced from other studies that an indicator with a CVR value equal or greater than 0.29 is essential based on stakeholders’ perception (Wilson et al., 2012; Lawshe, 1975).

In addition to the CV and CVR, the analysis of variance (ANOVA) was also calculated to determine whether the rating average values from both institutional stakeholders and residents were statistically significant. With a null hypothesis that "*both categories of stakeholders have the same perception on sustainability dimensions and indicators*", having a p-value less than or equal to 0.05 (the significance level) will lead to the rejection of the hypothesis. It means that the differences in the rating averages are statistically significant. However, if the p-value is greater than 0.05, it shows that the rating averages are statistically insignificant, and therefore the null hypothesis is not rejected. That is, it will not be accepted that "both categories of stakeholders have the same perception of sustainability dimensions and indicators".

The quantitative data obtained from questionnaire B (the pair-wise comparison of the sustainability indicators indicating the participants' relative preferences of the sustainability factors) was analysed using the Business Performance Management Singapore (BPMSG) AHP Online system where weights were elicited to the indicators. The BPMSG AHP Online system is a free web-based AHP solution designed to act as a support tool for decision-making processes.

3.8 Validity and Reliability of Research Design

Validity is "the property of a research instrument that measures its relevance, precision and accuracy" (Sarantakos, 2013: 99). It is the verification process of the findings in research, showing whether the research measures what it was intended to measure and how truthful the findings are (Dangana, 2015; Sarantakos, 2013). It is desirable that every component of a research design is empirically justifiable and validly arrived at, including the research approach (quantitative, qualitative, or mixed-methods), data collection and analysis. Although validity instruments used for qualitative research differ from that of quantitative research, both serve the purpose of checking the relevance and quality of data, results, and interpretation (Creswell and Clark, 2011). The reliability of a method refers to the degree to which it repeatedly produces stable and consistent results (Meriam 1995: 55), thus the extent to which one's findings will be found again under the same objects (Easterby-

Smith et al., 2012; Sarantakos, 2013: 104). To this end, the following were addressed to assure the validity and reliability of the research undertaken.

3.8.1 Internal Validity

This measures the truthfulness of the research process and findings using appropriate criteria, addressing the extent to which a research design claims to accurately answer a research question. It considers the consistency of the data obtained, the robustness of analysis applied, and the collective use of the data and methods to make valid inferences in a study.

In this study, statistical techniques (AHP) and tests (WA, CV, CVR) enhanced validity by serving to confirm the robustness of the quantitative analysis, with acknowledged levels of statistical confidence. Moreover, by using the tests in a confirmatory approach so that CV, CVR and AHP results were considered together, akin to triangulation, the validity of a decision e.g. choice of an indicator, was enhanced. This was a case of applying multiple techniques in the research design to underpin validity. The internal validity of the study can further be enhanced based on comparing the findings with existing studies, in what Sarantakos (2013) referred to as cumulative internal validity. For example, in the context of this study, the weight of the indicator set as one of its characteristics would be compared with similar ones in existing NSAFs to know if there is any similarity or differences. The internal validity was further strengthened by presenting the results to the stakeholders to ascertain the acceptability and usefulness of the indicator set as presented in section 3.6.3. This is a form of pragmatic validity, which looks at research from a prescriptive-driven perspective, focusing on the solutions preferred.

3.8.2 External Validity

This refers to the extent the research findings can be generalised to a wider population and to other contexts beyond that of the study (Dangana, 2015). Firstly, the choice of Lagos allows the result to be potentially generalisable to other Nigerian and SSA cities. This is with the assumption that although peculiarities exist in various contexts, these cities tend to encounter similar geographical, socio-economic and politico-cultural conditions and challenges of urbanisation (Ibem and Aduwo, 2015). Secondly, an attempt was made within the research context to use a sample size (n=309 and n=21), that could be amenable to statistical testing, within acceptable confidence limits, allowing for the making of defensible inferences. This is what occurred within the CV, CVR and AHP tests. While the representativeness of the sample size of the AHP technique may be questioned (where n=29), it is noteworthy that the AHP does not rely on large sample size (unlike the traditional survey) for validity because it is applied on a research focusing on a specific issue (Cheng et al., 2002; Schmidt et al., 2015). Cheng et al. (2002) further argued that the AHP technique may be impossible and impracticable for a survey with a large sample size as uninterested participants have a great tendency to provide arbitrary answers resulting to a high degree of inconsistency. For example, Akadiri (2011); Cheng and Li (2002); and Dangana (2015) used 19, 9 and 15 participants respectively. In this study, participants were selected from each category of the relevant stakeholders.

3.8.3 Internal and External Reliability

Internal reliability assures that the same result would be obtained if the research is repeated in the same context. This was enhanced in this study through the transparency of the research design and process, from the research assumptions, identification of the research participants, to data collection and analysis. The deference to critical realism as a philosophical lens provided insight that was more grounded in the contextual reality of metropolitan Lagos, providing valid explanations to some of the findings. On the other hand, external reliability assures the same result if the study is to be repeated in another context using the same procedure. Because this study is anchored on the context-specificity of sustainability, the result may be obtained in other Nigerian and other SSA cities who have similar development trend, values, and approach to physical planning. Again, the statistically reliable values underpin this validity.

3.9 Ethical Consideration

In this research, consideration was given to some key ethical issues like: data storage and access; informed consent of participants; their confidentiality; anonymity; and right to withdrawal at any stage of the research without giving reasons. Prior to data collection, the participant information sheet (appendix 3.3) and participant consent form (appendix 3.4) were sent to the potential participants in the category of the institutional stakeholders while residents were adequately briefed before administering questionnaires to them. This was done for participants to know the scope of the research; what their involvement would entail; and time commitment. Confidentiality of the participants was guaranteed as data could not easily be linked to any of the participants. The participants were anonymised by assigning a nomenclature (e.g. p1) to each of them to maintain their confidentiality. In this study, children under the age of 18; vulnerable participants; and people with communication difficulties were not involved. Data collected was stored in the Microsoft database that has been developed which was uploaded weekly into Box account as a back-up to prevent loss of data. Although the data has now been transferred to OneDrive which is the new storage of the University. The data will be stored in the first instance for twenty years. In addition, all protocols under the university Data protection policy were observed.

This research process passed through the University of Dundee's Research Ethics Committee with the ethical approval granted on 23rd August 2017 (appendix 3.1).

CHAPTER 4 RESULTS AND FINDINGS

This chapter delivers research objectives 2, 3, 4 and 5. It presents the results from the questionnaires administered to relevant stakeholders. Structured into five sub-sections, the first captures stakeholders' understanding of a sustainable neighbourhood; the second and third presents their perceptions and preferences of sustainability indicators respectively through which some indicators were selected; the fourth presents the result from the validation of the indicator set; the fifth delivers the characteristics of the selected indicator set using the various approaches discussed in section 2.8. The chapter concludes with a summary of the key findings.

4.1 Stakeholders' Understandings of Sustainable Neighbourhood

This sub-section presents a collective understanding of the concept of a sustainable neighbourhood within the context of Lagos. Through thematic analysis, the stakeholders' understandings of a sustainable neighbourhood were clustered using the 10 themes that emerged from the literature review using the NVivo software (figure 4.1). The findings are based on the understandings of regulators, developers, and built-environment professionals (collectively known as institutional stakeholders), and residents of selected neighbourhoods as subsequently presented.

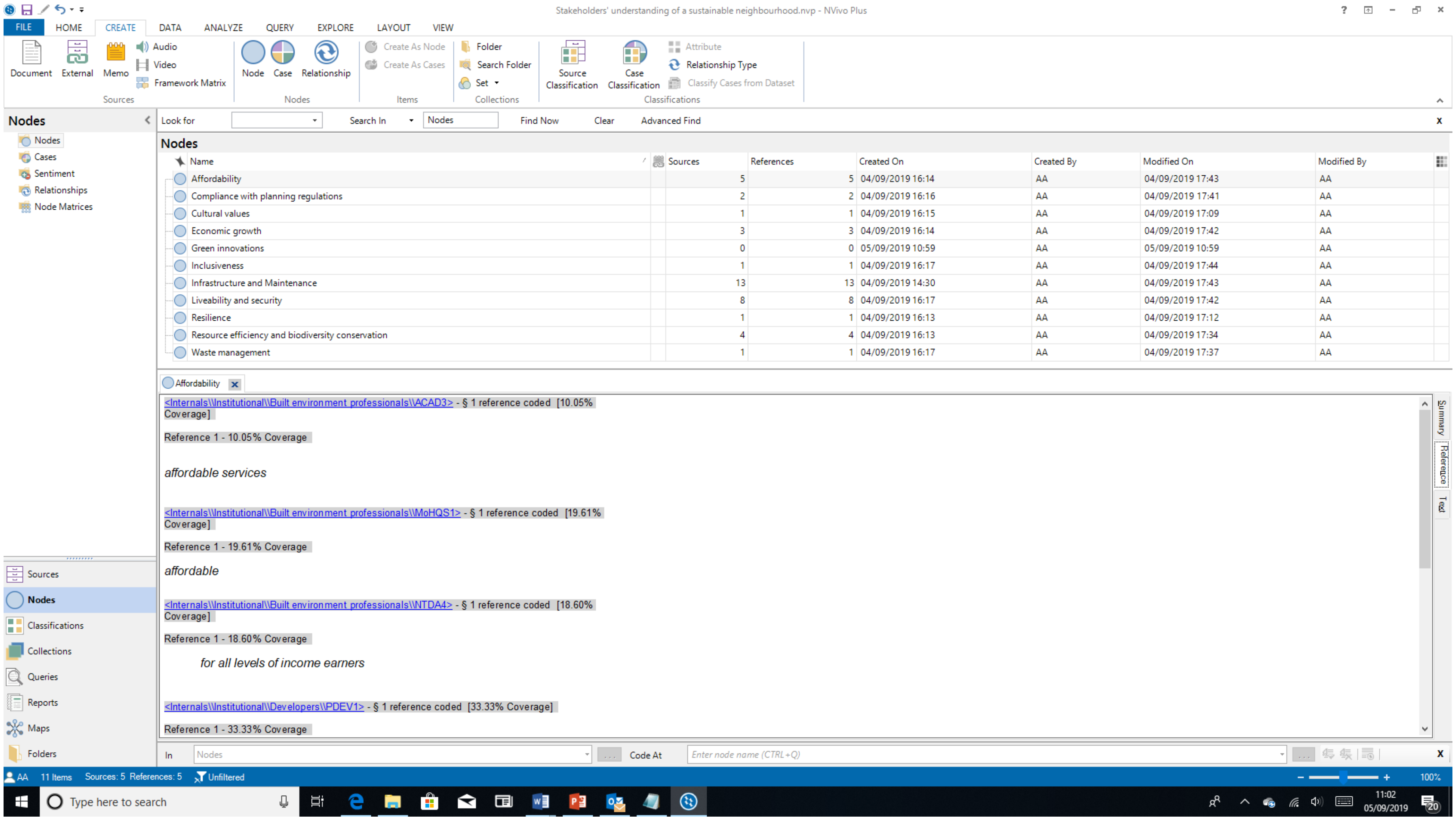

Figure 4. 1: Thematic analysis of findings using the 10 themes from literature with a new theme "compliance with planning regulation" emerging
Source: Author, 2020

4.1.1 Institutional Stakeholders (regulators, developers, and built environment professionals)

Regulators

The appreciable years of experience across all the categories of institutional stakeholders (tables 4.1, 4.2, and 4.3) of the respondents indicates a level of experience that underpins reliability in their perspectives.

Table 4. 1: Year of experience of respondents from regulatory institutions

Regulatory institutions and anonymised name	Respondents' years of experience
Ministry of Physical Planning and Urban Development (MPPUD)	11-20 years
Lagos State Building Control Agency (LABCA)	11-20 years
Lagos State Physical Planning and Development Authority (LASPPDA)	11-20 years
New Town Development Authority (NTDA)	6-10 years

Source: Author, 2020

The regulators' understandings of a sustainable neighbourhood are presented hereafter:

LABCA defined a sustainable neighbourhood using the Brundtland commission's perspective which can be mapped under two themes of "infrastructure and maintenance", and "resource efficiency and biodiversity conservation".

> *"an estate developed to meet the needs of both present and future generations' users while considering and minimising the consumption and waste of energy"*

Meanwhile, the understanding of the LASPPDA can be mapped under the two themes of "liveability and security"; and "economic growth".

> "*one that is liveable, workable, that supports environmental equity with catalyst for growth, urban regeneration, secured with economic enhancement"*

MPPUD also shared a similar understanding with its subsidiary agency (LASPPDA) by explaining sustainable neighbourhood from the liveability perspective as one that is not overcrowded or congested.

"one that can be attained in such a way that it can take the number of people or populace that is required"

NTDA defined a sustainable neighbourhood from the perspective of the one that has a strategy to maintain its infrastructure.

"One that would have adequate management framework for routine turn around maintenance and other legislations that can address other urban development problems"

The NVivo result showed variation in their understandings of a sustainable neighbourhood (figure 4.2).

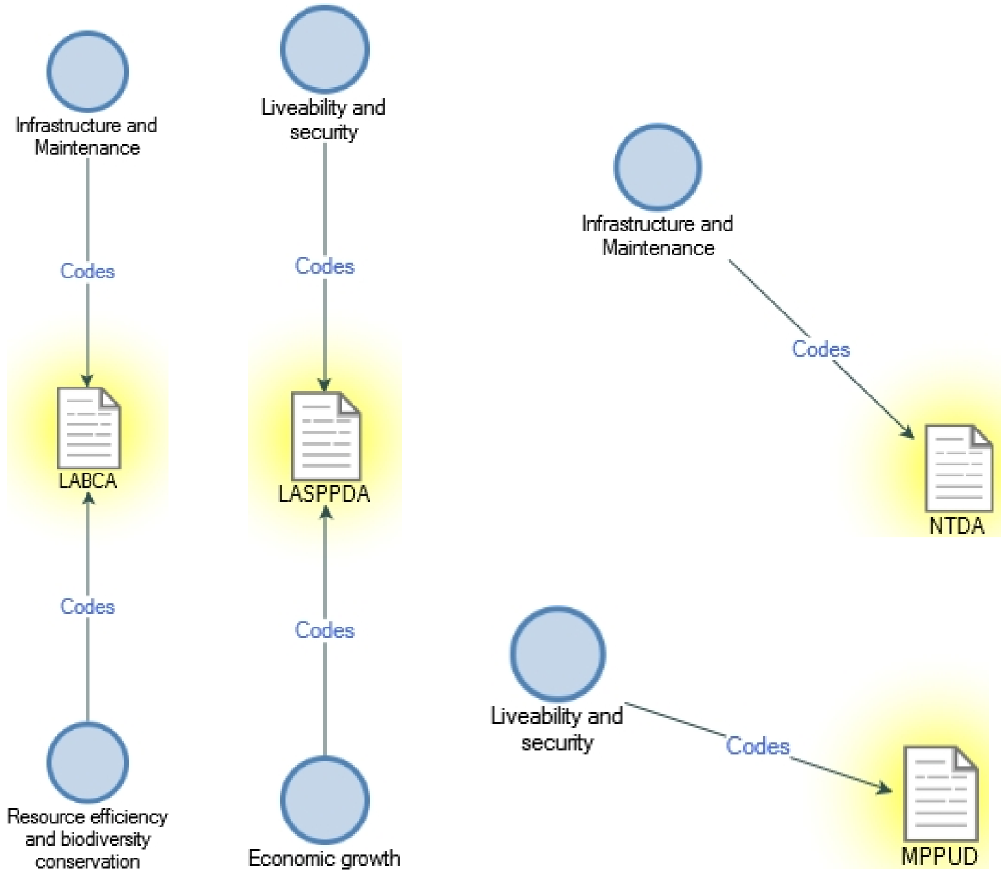

Figure 4. 2: The variation in regulators' understanding of a sustainable neighbourhood
Source: Author, 2020

It is noteworthy that out of the 10 themes that emerged from the generic international literature, only four themes were captured by the regulators' understanding of the concept of a sustainable neighbourhood with other themes (inclusiveness, resilience, waste management, green innovations, cultural values, and affordability) not reflecting. Also, “infrastructure and maintenance” and “liveability and security” has 2 entries (from LASPPDA and MPPUD) indicating the importance of themes in describing a sustainable neighbourhood (figure 4.3). The other two themes have 1 entry each.

Figure 4. 3: The four themes that captured regulators' understanding of sustainable neighbourhood with infrastructure and maintenance and liveability and security being the dominant
Source: Author, 2020

Developers

Table 4.2 presents the background information of the developers.

Table 4. 2: Years of experience of respondents

Institutions and anonymised name	Respondents' year of experience
Ministry of Housing (MoH)	Above 20 years
Lagos State Development and Property Corporation (LSDPC)	11-20 years
Lagos Building Investment Company (LBIC)	11-20 years
Private Developer (PDEV1)	6-10 years
Private Developer (PDEV2)	Above 20 years

Source: Author, 2020

The developers' understandings of a sustainable neighbourhood are presented hereafter:

MoH had a similar understanding of a sustainable neighbourhood with LASBCA because it also adopted the Brundtland Commission's definition of sustainability, which has to do with meeting needs of both present and future generations with emphasis on housing.

> *"one that meets the current housing needs without compromising the ability of future generations to meet their own needs".*

The definition from LSDPC of a sustainable neighbourhood can be mapped under the two themes (or aspects) of: "cultural values" and "economic growth".

> "*a built environment with minimum negative impact on socio-cultural and economic activities*"

It is noteworthy that LBIC had a similar understanding with the NTDA that a proper management framework is what makes a neighbourhood sustainable.

> "*an estate that is not abandoned, where proper management is available*"

In contrary, the understanding of a sustainable neighbourhood by of one of the private developers can be mapped under the two themes of "affordability" and "resilience"

> "*affordable housing that can stand the test of time*"

Sharing similar views, another private developer- PDEV2 submits that the sustainability of a neighbourhood anchors on the two themes of “affordability” and “resource efficiency and biodiversity conservation”.

> “*housing development that is cost-effective and affordable to all and sundry*”

The result showed variations in the developers’ understandings of a sustainable neighbourhood (figure 4.4).

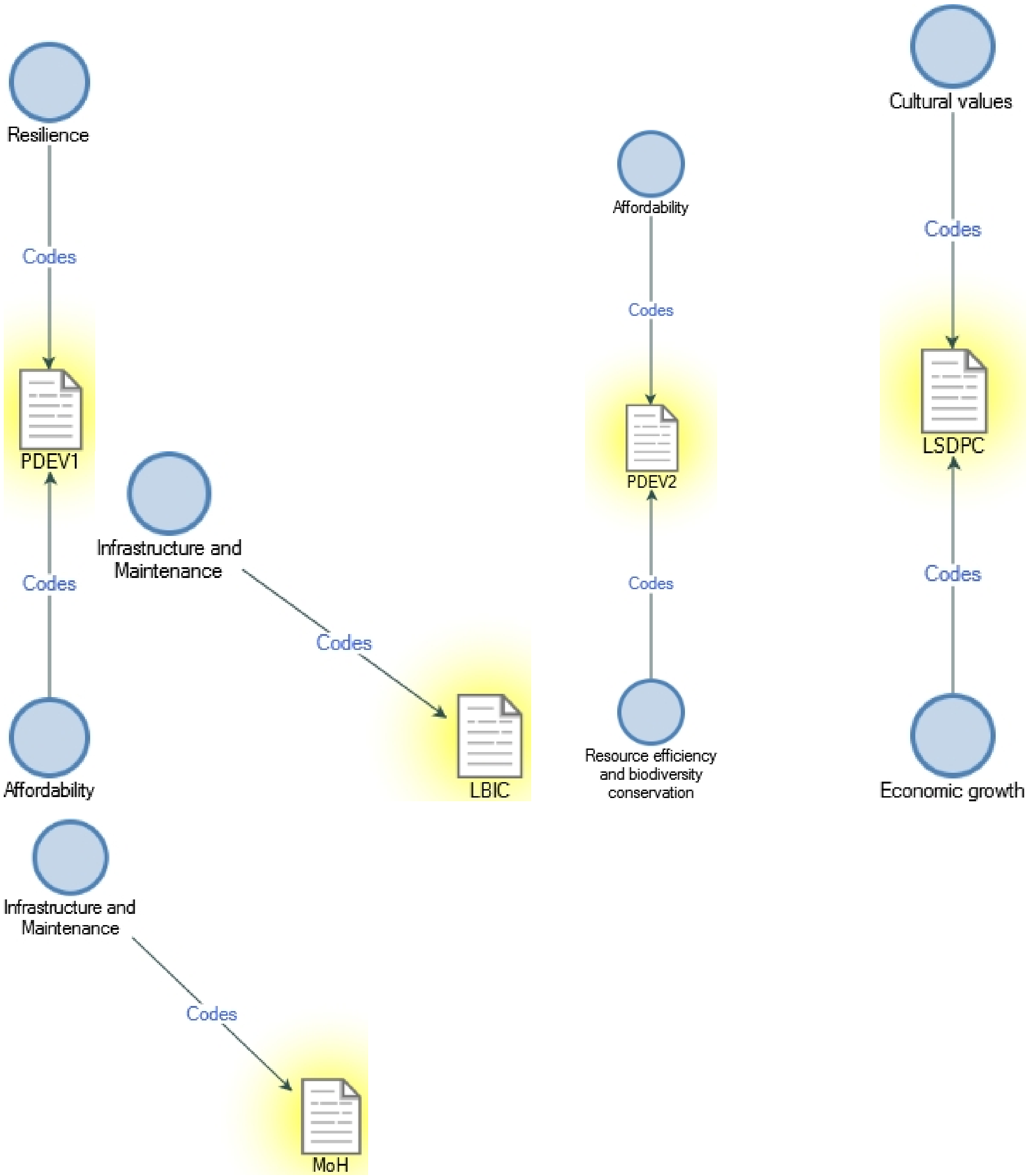

Figure 4. 4: The variations in developers’ understanding of a sustainable neighbourhood
Source: Author, 2020

Also, out of 10 themes that emerged from literature, the developers' understanding captured 6 of the themes leaving out "green innovations", "inclusiveness", "waste management", and "liveability and security". In this instance, "affordability" and "infrastructure and maintenance" have the highest entries of 2 while "cultural values" and "resource efficiency and biodiversity conservation" had one each (figure 4.5).

Figure 4. 5: The 6 themes capturing developers' understanding of a sustainable neighbourhood with affordability and infrastructure and maintenance being the dominant
Source: Author, 2020

Built Environment Professionals

Table 4.3 presents the background information of professionals from the various institutions responsible for neighbourhood development and regulation in metropolitan Lagos.

Table 4. 3: Background information of built environment professionals from ministries and agencies

Profession	Institutional affiliation	Anonymised name	Years of experience
Town Planner	New Town Development Authority (3 Nos)	NTDA2	6-10 years
Town Planner		NTDA3	6-10 years
Town Planner		NTDA4	6-10 years
Builder	Ministry of Housing Architecture and Building Services section (1 No)	MoH ABS2	11-20 years
Civil Engineer	Engineering section (2 Nos)	MoH ENG1	11-20 years
Civil Engineer		MoH ENG2	11-20 years
Quantity Surveyor	Quantity Surveying section (1 No)	MOH QS1	6-10 years
Town Planner	Lagos State Building Control Agency	LABCA1	6-10 years
Town Planner	Lagos State Building Control Agency	LABCA3	6-10 years
Architect/Academia	Obafemi Awolowo University, Nigeria	ACAD1	Above 20 years
Architect/Academia	Obafemi Awolowo University, Nigeria	ACAD2	Above 20 years
Architect/Academia	University of New South Wales, Australia	ACAD3	Above 20 years

Source: Author, 2020

The understandings of the built environment professionals of a sustainable neighbourhood are presented hereafter:

NTDA2 understood a sustainable neighbourhood from the perception of the Brundtland's commission as the one that meets the needs of future generation with basic infrastructure.

> *“a neighbourhood can be considered sustainable if future generation can benefit some quality of housing and its supporting facilities without hindrance”*

MoH ABS2 defined a sustainable neighbourhood as that which meets the need of only present generation with consideration for environmental integrity.

> “*a neighbourhood that meets the needs of the present without compromising the integrity of the environment*

ACAD2 defined it as that which meets both present and future needs.

> *“a neighbourhood that is planned to meet the present or current needs of the occupants and also provides opportunities for all envisaged future needs and requirements – in terms of basic infrastructural facilities and such other housing needs”*

Although from the same agency with NTDA2, the definition by NTDA3 can be mapped under the three themes of “infrastructure”, “resource efficiency and biodiversity conservation”, and “liveability and security”

> “*a self-sustaining place that has all basic form of complementary uses. It is one that makes effective use of available resources to maximally create quality, liveable, working, and light commercial based area for living*”

NTDA4 shared similar understanding with NTDA3 but went further to include to affordability as a key theme that defines a sustainable neighbourhood in the context of metropolitan Lagos in addition to “infrastructure and maintenance”, resource efficiency and biodiversity conservation”, and “affordability”.

> *“a well-planned area of land with buildings and functional infrastructure, economically, and environmentally designed to produce shelter for all levels of income earners”*

ACAD1; MoH ENG1; and MoH ENG2 shared similar understanding as their definition can be mapped under “infrastructure” except for ACAD1 which included “liveability and security” and MoH ENG1 that extended the definition to “waste management”.

ACAD1- *“a well-thought-out layout made up of building units which are well serviced and capable of provisioning secured habitable environment for human comfort”*

MoH ENG1- *“a well laid out area with good road network and such infrastructural facilities as power, water, central sewage and recreational area”*

MoH ENG2- *“one that has a regular power and water supply”*

MoH QS1 defined a sustainable neighbourhood as that which is ‘affordable’ and ‘liveable’

MoH QS1- *“one that is affordable and habitable for living*”

With a different understanding and perception, LABCA1 and LABCA3 both emphasised that a neighbourhood is considered sustainable when it follows physical planning regulations. Besides, LABCA1 added liveability.

LABCA1- *“an environment that is liveable, habitable and complies with planning regulations”*

ACAD3- *“a neighbourhood with good environmental quality, access to local economic opportunities, affordable services and amenities and with a sense of community, cultural identity and belonging”*

The mapping of the results with the 10 overarching themes that emerged from the literature showed variations in their understandings of a sustainable neighbourhood (figure 4.6) as presented hereafter:

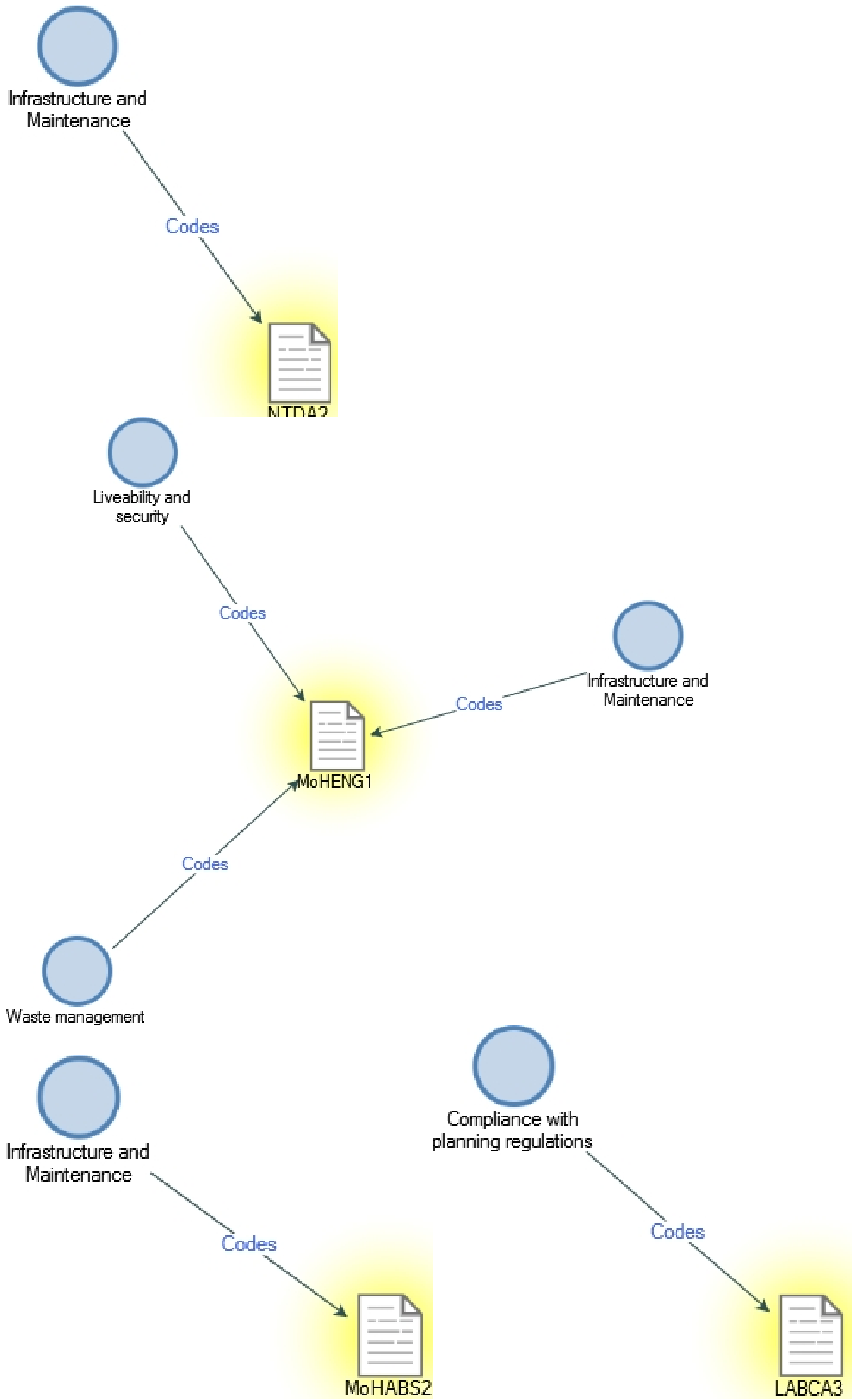

Figure 4. 6: The variation in selected built environment professionals' understanding of a sustainable neighbourhood
Source: Author, 2020

The built environment professionals' understandings captured 7 out of the 10 themes that emerged from literature leaving out "green innovations", "cultural values”, and “resilience” (figure 4.7). However, a new theme emerged which has to do with compliance with planning regulations. Their understandings showed that “infrastructure and maintenance” was emphasised having 9 entries followed by “liveability and security” with 5 entries with themes like “economic growth”, “inclusiveness”, and “waste management” having one entry each.

Figure 4. 7: The 7 themes capturing developers’ understanding of a sustainable neighbourhood with infrastructure and maintenance being the dominant
Source: Author, 2020

Overall, the results showed variations in the institutional stakeholders’ understandings of the sustainable neighbourhood concept. It is noteworthy that institutions that perform the same function (e.g. regulatory) have contrasting views while those that perform different functions shared similar perceptions and understanding of the concept. Amongst the 10 themes and the new theme that emerged, “infrastructure and maintenance”, “liveability and security”, and “affordability” dominated across the categories of the institutional stakeholders (figure 4.8).

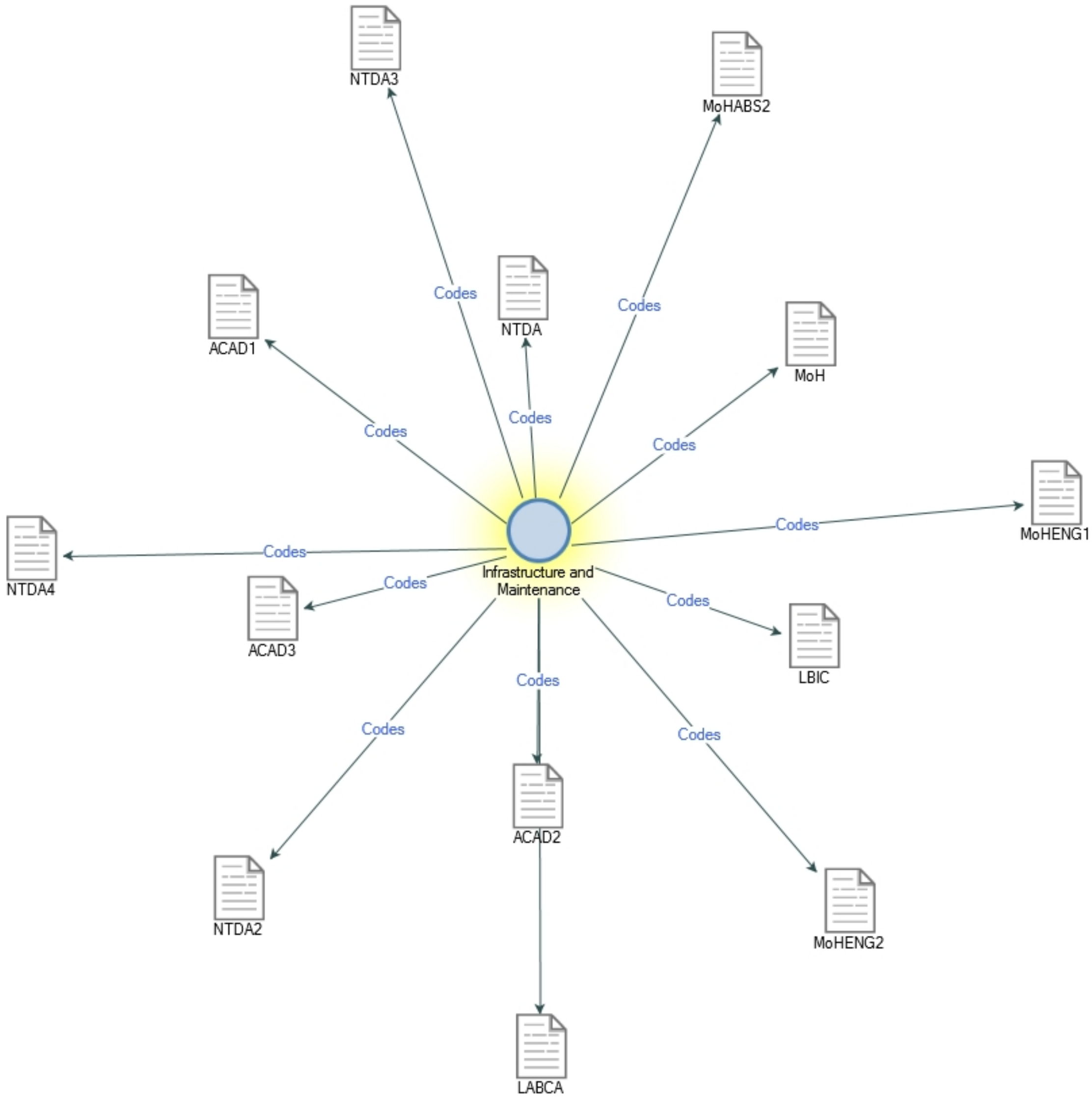

Figure 4. 8: the dominance of the infrastructure and maintenance theme in institutional stakeholders' perception
Source: Author, 2020

4.1.2 Residents

Out of the 309 respondents, 160 (51.78 per cent) were male, while 149 (48.22 per cent) were female indicating a gender balance (figure 4.9). 165 (53.07 per cent) were married; 135 (43.69 per cent) were single; 10 (3.24 per cent) were single parents (figure 4.10).

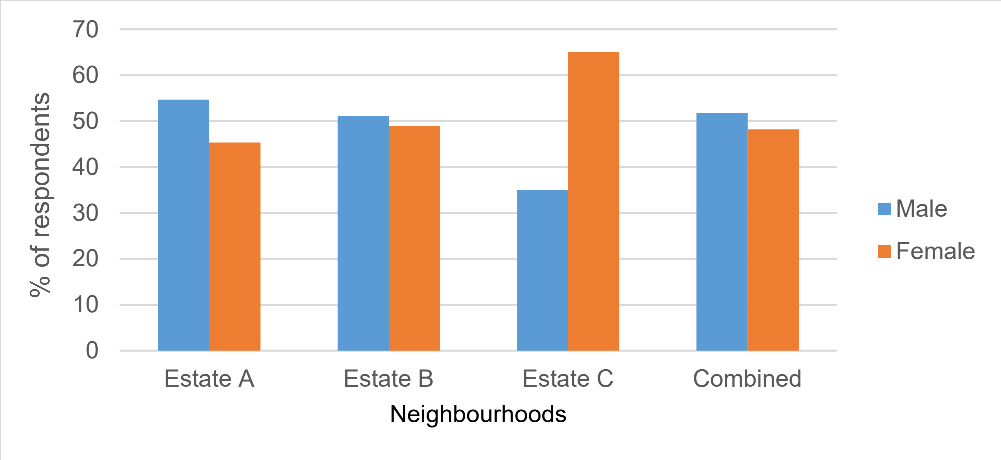

Figure 4. 9: Gender distribution of residents
Source: Author, 2020

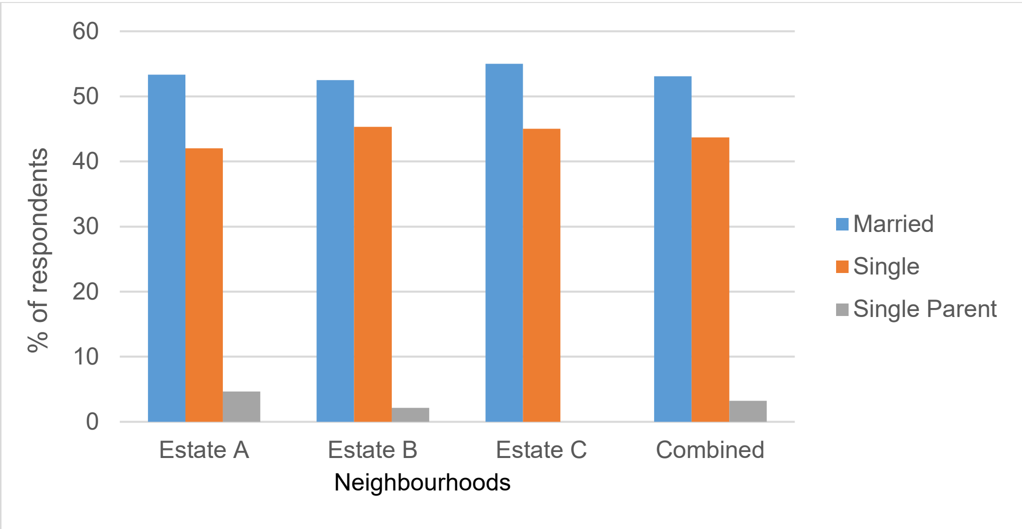

Figure 4. 10: Marital status of respondents
Source: Author, 2020

Each of the 309 respondents gave a description in terms of attributes that are essential in a neighbourhood that they aspire to see developed in Lagos. It is noteworthy that the attributes suggested by respondents could be mapped onto the themes that emerged from the literature. The attributes cover extensively issues relating to liveability, resource efficiency, and economic prosperity among others. In all, 781 attributes emerged (including those that were repetitive) describing residents' ideal neighbourhood. The frequency of each theme was also noted which helps to understand the level of importance attached to it by the residents. However, there was no theme that could be described under the overarching themes of “resilience”; “water management and biodiversity”; and “cultural values” (Table 4.4).

Table 4. 4: Mapping of responses from residents on the themes that emerged from the literature

Themes	Frequency and percentage	Corresponding theme from literature
Health facilities and wellbeing	51 (6.53%)	Infrastructure and maintenance
Infrastructure	214 (27.4%)	
Sport facilities	41 (5.25%)	
Transportation	35 (4.48%)	
Sense of belonging	28 (3.59%)	Inclusiveness
-	-	Resilience
Waste control	28 (3.59%)	Resource efficiency and waste management
-	-	Green innovations
Home affordability	6 (0.76%)	Affordable housing
Market and other retail outlets	78 (9.99%)	Economic prosperity
-	-	Water management and biodiversity
-	-	Cultural values
Neighbourhood planning and design	26 (3.33%)	Liveability and security
Nearness to facilities	7 (0.90%)	
Public buildings and outdoor spaces	156 (19.97%)	
Security and comfort	97 (12.42%)	
Affordable food	8 (1.02%)	

Source: Author, 2020

Table 4.4 shows that “infrastructure and maintenance” had the highest frequency (43.66 per cent) as it encapsulates such attributes like health facilities and wellbeing, sports facilities, infrastructure (water, electricity, drainage), and transportation. This was followed by “liveability and security” at 37.64 per cent covering sub-themes like neighbourhood planning and design; nearness to facilities; public buildings and outdoor spaces; security and comfort; and affordable food. The results align to that of institutional stakeholders because the two themes of “infrastructure and maintenance”, and “liveability and security” are also dominant.

4.2 Stakeholders’ Perceptions of Sustainability Indicators

This sub-section addresses research objectives 3 which focuses on stakeholders’ perceptions of the associated indicators in order to identify the indicators of a decision-making framework for metropolitan Lagos. It presents the institutional stakeholders’ and residents’ perceptions leading to the selection of some indicators as important in planning a sustainable neighbourhood in metropolitan Lagos based on the Coefficient of Variation (CV) and Content Validity Ratio (CVR) values.

4.2.1 Institutional Stakeholders

The frequency and percentage distribution for each of the sustainability indicators on a 5-point rating scale based on the stakeholders’ perceptions are presented in table 4.5. For example, 9 (42.86 per cent) agreed that the use of renewable energy is very important to be considered in planning for a sustainable neighbourhood; 9 (42.86 per cent) agreed that it is important; 3 (14.29 per cent) agreed that it is only moderately important; none considered it to be either slightly important or not important.

Table 4. 5: Frequency distribution of institutional stakeholders' perception of indicators (n=21)

Indicators	not important (1)	slightly important (2)	moderately important (3)	Important (4)	very important (5)
Use of renewable energy systems	0	0	3 (14.29%)	9 (42.86%)	9 (42.86%)
Waste collection and management	0	0	0	5 (23.81%)	16 (76.19%)
Strategy to maintain the infrastructure	0	0	1 (4.76%)	7 (33.33%)	13 (61.9%)
Environmental Impact Assessment	0	0	5 (23.81%)	6 (28.57%)	10 (47.62%)
Pollution control	0	0	2 (9.52%)	9 (42.86%)	10 (47.62%)
Green field preservation	0	0	5 (23.81%)	9 (42.86%)	7 (33.33%)
Effective land usage	1 (4.76%)	0	4 (14.29%)	9 (42.86%)	7 (76.19%)
Efficient use of resources	0	0	5 (23.81%)	5 (23.81%)	11 (52.86%)
Outdoor spaces	0	0	3 (14.29%)	3 (14.29%)	15 (71.43%)
Aesthetics	0	0	13 (61.90%)	2 (9.52%)	6 (28.57%)
Quality of construction material	0	0	0	3 (14.29%)	18 (85.71%)
Friendly pedestrian lane	0	0	0	5 (23.81%)	16 (76.19%)
Diverse mobility options	0	1 (4.76%)	2 (9.52%)	10 (47.62%)	8 (38.10%)
Nearness to basic amenities	0	1 (4.76%)	1 (4.76%)	7 (33.33%)	12 (57.14%)
Infrastructure and amenities	0	0	0	3 (14.29%)	18 (85.71%)
Security	0	0	2 (9.52%)	4 (19.05%)	15 (71.43%)
Access to potable water	0	1 (4.76%)	1 (4.76%)	1 (4.76%)	18 (85.71%)
Inclusive design	0	7 (33.33%)	7 (33.33%)	7 (33.33%)	8 (38.10%)
Home garden	3 (14.29%)	5 (23.81%)	5 (23.81%)	5 (23.81%)	3 (14.29%)
Active frontages	6 (28.57%)	5 (23.81%)	7 (33.33%)	2 (9.52%)	1 (4.76%)
Use of locally made material	5 (23.81%)	6 (28.57%)	6 (28.57%)	2 (9.52%)	2 (9.52%)
Provision of neighbourhood square	0	1 (4.76%)	2 (9.52%)	10 (47.62%)	8 (38.10%)
Home affordability	0	2 (9.52%)	3 (14.29%)	4 (19.05%)	12 (57.14%)
Support for home-based business	1 (4.76%)	3 (14.29%)	5 (23.81%)	6 (28.57%)	6 (28.57%)
Cost of construction, operation, and maintenance	0	0	2 (23.81%)	8 (28.57%)	11 28.57%)

Source: Author, 2020

The stakeholders' perceptions were further regrouped into three main scales to understand their level of importance and non-importance. That is, by combining values of slight with moderate importance (which signifies that the indicator is only important to an extent); and values of important with very important (which signifies that the indicator is important to a great extent and indispensable). This showed the following three results: One, all the institutional stakeholders perceived 'Quality of construction material'; 'Friendly pedestrian lane'; Waste collection and management; and 'Infrastructure and amenities to be important'. Two, a majority of institutional stakeholders (over 75 per cent) also perceived 'Use of renewable energy systems'; Strategy to maintain the infrastructure; Pollution control; Outdoor spaces; Diverse mobility options; Nearness to basic amenities; Security; Access to potable water; and 'Cost of construction, operation, and maintenance'; Environmental Impact Assessment; Greenfield preservation; Effective land usage; Efficient use of resources; 'Use of locally-made material'; 'Provision of neighbourhood square; and Home affordability to be important. Three, more than half (above 60 per cent) of the respondents perceived that 'Aesthetics'; and 'Inclusive design' are only important to some extent. Also, more than a quarter (28.57 per cent) of the respondents perceived that 'Active frontages to encourage shops' is not important in a neighbourhood that can be considered sustainable.

4.2.2 Residents

The frequency and percentage distribution for each of the sustainability indicators on a 5-point rating scale based on the residents' perceptions are presented in table 4.6. For example, 132 (42.72 per cent) agreed that the use of renewable energy systems is very important to be considered; 99 (32.04 per cent) agreed that it is important; 40 (12.94 per cent) agreed that it is only moderately important; 24 (7.77 per cent) rate it to be slightly important; and 14 (4.53 per cent) were of the opinion that waste collection and management is not important.

Table 4. 6: Frequency distribution of residents' perception of indicators (n=309)

Indicators	**not important (1)**	**slightly important (2)**	**moderately important (3)**	**Important (4)**	**very important (5)**
Use of renewable energy systems	14 (4.53%)	24 (7.77%)	40 (12.94%)	99 (32.03%)	132 (42.72%)
Waste collection and management	1 (0.32%)	13 (4.21%)	17 (5.50%)	100 (32.36%)	178 (57.61%)
Strategy to maintain infrastructure	3 (0.97%)	8 (2.59%)	32 (10.36%)	136 (44.01%)	130 (42.07%)
Environmental Impact Assessment	4 (1.29%)	26 (8.41%)	53 (17.15%)	118 (38.19%)	108 (34.95%)
Pollution control	5 (1.62%)	9 (2.91%)	20 (6.47%)	116 (37.54%)	159 (51.46%)
Green field preservation	15 (4.85%)	34 (11.00%)	57 (18.45%)	108 (34.95%)	95 (30.74%)
Effective land usage	17 (5.50%)	22 (7.12%)	56 (18.12%)	121 (39.16%)	93 (30.10%)
Efficient use of resources	3 (0.97%)	0	13 (4.21%)	63 (20.39%)	230 (74.43%)
Outdoor spaces	9 (2.91%)	8 (2.59%)	37 (11.97%)	73 (23.62%)	182 (58.90%)
Aesthetics	13 (4.21%)	29 (9.39%)	40 (12.94%)	145 (46.93%)	82 (26.54%)
Quality of construction material	2 (0.65%)	11 (3.56%)	17 (5.50%)	94 (30.42%)	185 (59.87%)
Friendly pedestrian lane	5 (1.62%)	2 (0.65%)	18 (5.83%)	91 (29.45%)	193 (62.46%)
Diverse mobility options	3 (0.97%)	8 (2.59%)	42 (13.59%)	114 (36.89%)	142 (45.95%)
Nearness to basic amenities	4 (4.21%)	13 (2.59%)	29 (9.39%)	93 (30.10%)	170 (55.02%)
Infrastructure and amenities	3 (0.97%)	6 (1.94%)	9 (2.91%)	63 (20.39%)	228 (73.79%)
Security	2 (0.65%)	7 (2.27%)	27 (8.74%)	93 (30.10%)	180 (58.25%)
Access to potable water	5 (1.62%)	2 (0.65%)	22 (7.12%)	90 (29.13%)	190 (61.49%)
Inclusive design	3 (0.97%)	17 (5.50%)	39 (12.62%)	128 (41.42%)	122 (39.42%)
Home garden	47 (31.07%)	18 (28.48%)	60 (19.42%)	88 (5.83%)	96 (15.21%)
Active frontages	44 (12.24%)	51 (16.50%)	59 (19.42%)	110 (35.60%)	45 (15.21%)
Use of locally made material	53 (17.15%)	44 (14.24%)	70 (22.65%)	79 (25.57%)	63 (20.39%)
Provision of neighbourhood square	15 (4.85%)	15 (4.85%)	65 (21.04%)	102 (33.01%)	112 (36.25%)
Home affordability	9 (2.91%)	4 (1.29%)	19 (6.15%)	102 (33.01%)	175 (56.63%)
Support for home-based business	10 (3.24%)	8 (2.59%)	27 (8.74%)	123 (39.81%)	141 (45.63%)
Cost of construction, operation, and maintenance	4 (1.29%)	9 (2.91%)	13 (4.21%)	115 (37.22%)	168 (54.37%)

Source: Author, 2020

The residents' perceptions can further be regrouped into three main scales to further understand their level of importance and non-importance. That is, by combining values of slight with moderate importance (which signifies that the indicator is only important to an extent); and values of important and very important. This, for example, showed the following:

- None of the indicators recorded 100 per cent agreement from the respondents as observed in the responses of the institutional stakeholders;

- Majority of the residents (over 80 per cent) perceived that 'Waste collection and management'; 'Strategy to maintain the infrastructure'; 'Pollution control'; 'Efficient use of resources'; 'Outdoor spaces'; 'Quality of construction material'; 'Friendly pedestrian lane'; 'Nearness to basic amenities'; 'Infrastructure and amenities'; 'Security'; 'Access to potable water'; 'Inclusive design'; 'Home affordability'; 'Support for home-based business'; and 'Cost of construction, operation, and maintenance;

- More than a quarter (31.07 per cent) of the respondent perceived that 'Home garden' is not important in planning for a sustainable neighbourhood in metropolitan Lagos.

4.2.3 Selected Indicator Set

Using Microsoft excel functions, the weighted average (WA); standard deviation (SD); co-efficient of variation (CV); and the content validity ratio (CVR) of the indicators were calculated using the frequency distribution presented in sections 4.2.1 and 4.2.2 (Table 4.7). These values were useful to statistically determine which of the indicators reached consensus and could subsequently be selected.

Table 4. 7: The WA, CV, and CVR of the indicators based on stakeholder's perception (n=21 for institutional stakeholders (inst.); n=309 for residents (res.))

Indicators	**WA**		**SD**		**CV**		**CVR**	
	Inst.	**Res.**	**Inst.**	**Res.**	**Inst.**	**Res.**	**Inst.**	**Res.**
Use of renewable energy	4.29	4.01	1.44	1.34	0.34	0.33	0.71	0.50
Waste collection & management	4.76	4.43	1.72	1.51	0.36	0.34	1.00	0.80
Facility management	4.57	4.24	1.59	1.42	0.35	0.34	0.90	0.72
Environmental Impact Assessment	4.24	3.97	1.42	1.33	0.34	0.33	0.52	0.46
Pollution control	4.38	4.34	1.49	1.47	0.34	0.34	0.81	0.78
Green field preservation	4.10	3.76	1.37	1.29	0.33	0.34	0.52	0.31
Effective land usage	4.00	3.81	1.34	1.30	0.33	0.34	0.52	0.39
Efficient use of resources	4.29	4.67	1.44	1.66	0.34	0.35	0.52	0.90
Outdoor spaces	4.57	4.33	1.59	1.46	0.35	0.34	0.71	0.65
Aesthetics	3.67	3.82	1.29	1.30	0.35	0.34	0.24	0.47
Quality of construction material	4.86	4.45	1.78	1.53	0.37	0.34	1.00	0.81
Good pedestrian lane	4.76	4.50	1.72	1.56	0.36	0.35	1.00	0.84
Diverse mobility option	4.19	4.24	1.40	1.42	0.33	0.34	0.71	0.66
Nearness to amenities & infrastructures	4.43	4.33	1.51	1.46	0.34	0.34	0.81	0.70
Availability of infrastructure &amenities	4.86	4.64	1.78	1.64	0.37	0.35	1.00	0.88
Security	4.62	4.43	1.62	1.51	0.35	0.34	0.81	0.77
Access to reliable and potable water	4.71	4.48	1.69	1.54	0.36	0.34	0.81	0.81
Inclusive design	4.05	4.13	1.35	1.38	0.33	0.33	0.43	0.62
Use of locally made material	*4.00*	*3.18*	*1.34*	*0.44*	*0.33*	*0.44*	*0.43*	***-0.08***
Provision of neighbourhood square	4.19	3.91	1.40	0.34	0.33	0.34	0.71	0.39
Home affordability	4.24	4.39	1.42	0.34	0.34	0.34	0.52	0.79
Support for home-based business	3.62	4.22	1.29	0.33	0.36	0.33	0.34	0.71
Cost of construction, operation, & maintenance	4.43	4.40	1.51	0.34	0.34	0.34	0.81	0.83
Home garden for local food production	***3.00***	*3.54*	***1.60***	*1.30*	***0.53***	*0.37*	***-0.24***	***0.19***
Active frontages to encourage shops	***2.38***	*3.20*	***1.85***	*1.38*	***0.78***	*0.43*	***-0.71***	***0.00***

Source: Author, 2020

The CV values of the indicators based on the institutional stakeholders' perception showed a similar pattern and value (figure 4.11). This implied a high degree of similarity in their perceptions of the indicators. However, 'active frontages' with a CV value of 0.78 indicates that stakeholders' perception varied substantially. Also, the perception of stakeholders also seems to vary on 'home garden to support food' with a CV of 0.53. As a result, the two indicators will not be included in the selected indicator set (because they have CVs greater than 0.5).

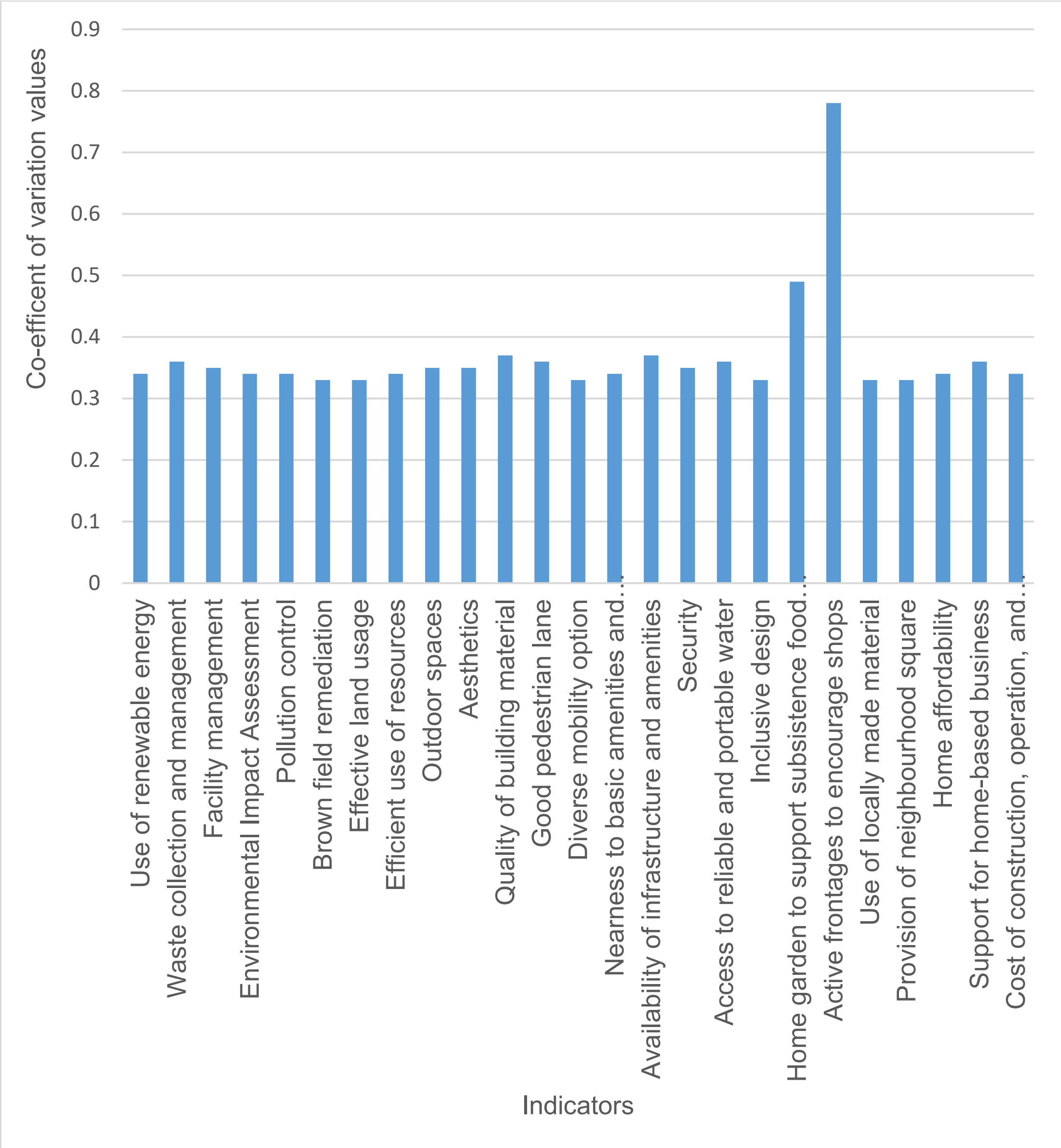

Figure 4. 11: Co-efficient of variation values of indicators based on institutional stakeholders' perception
Source: Author, 2020

The CVR values which shows how essential an indicator is, further helped to select the indicators. Using the -1 (perfect disagreement) to +1 (perfect agreement) scale, there was a perfect disagreement on ‘home garden to support food’, and ‘active frontage for shops’ with a CVR of -0.24 and -0.71 respectively. Therefore, all the other indicators can be considered essential to stakeholders as their statistical values showed a perfect agreement across stakeholders. For example, ‘waste collection and management’; ‘good pedestrian lane’; ‘availability of infrastructure and amenities’ had a CVR of 1.00 indicating perfect agreement among stakeholders about how essential they are in planning for a sustainable neighbourhood.

There was a similar result based on residents’ perception. None of the 25 extracted indicators had a CV less than 0.5, but three of the indicators have a CVR less than 0.29 (table 4.7). Two of which are: ‘*home garden to support local food production*’ and ‘*active frontage to support shops*’. The other one is ‘*use of locally made material*’, although with the lowest CVR but with the highest CV of 0.44 will be part of the distilled indicators because of a higher rating average of 4.00 it received from the institutional stakeholders.

The CV and CVR values, therefore, helped to select the 23 indicators that are suitable for assessing a new neighbourhood development in metropolitan Lago from the 25 that were extracted from literature based on their inherent statistical significance as indicated by respondents.

4.2.4 Patterns of Stakeholders’ Perceptions

The patterns or trends in the perception of stakeholders in identifying the indicator set was explained based on factors such as the neighbourhood of residence, age group, income level, and categories of stakeholders (i.e. either institutional or residents).

Perception across the neighbourhood of residence

The weighted averages (WA) of the indicators varied across the neighbourhoods (figure 4.12).

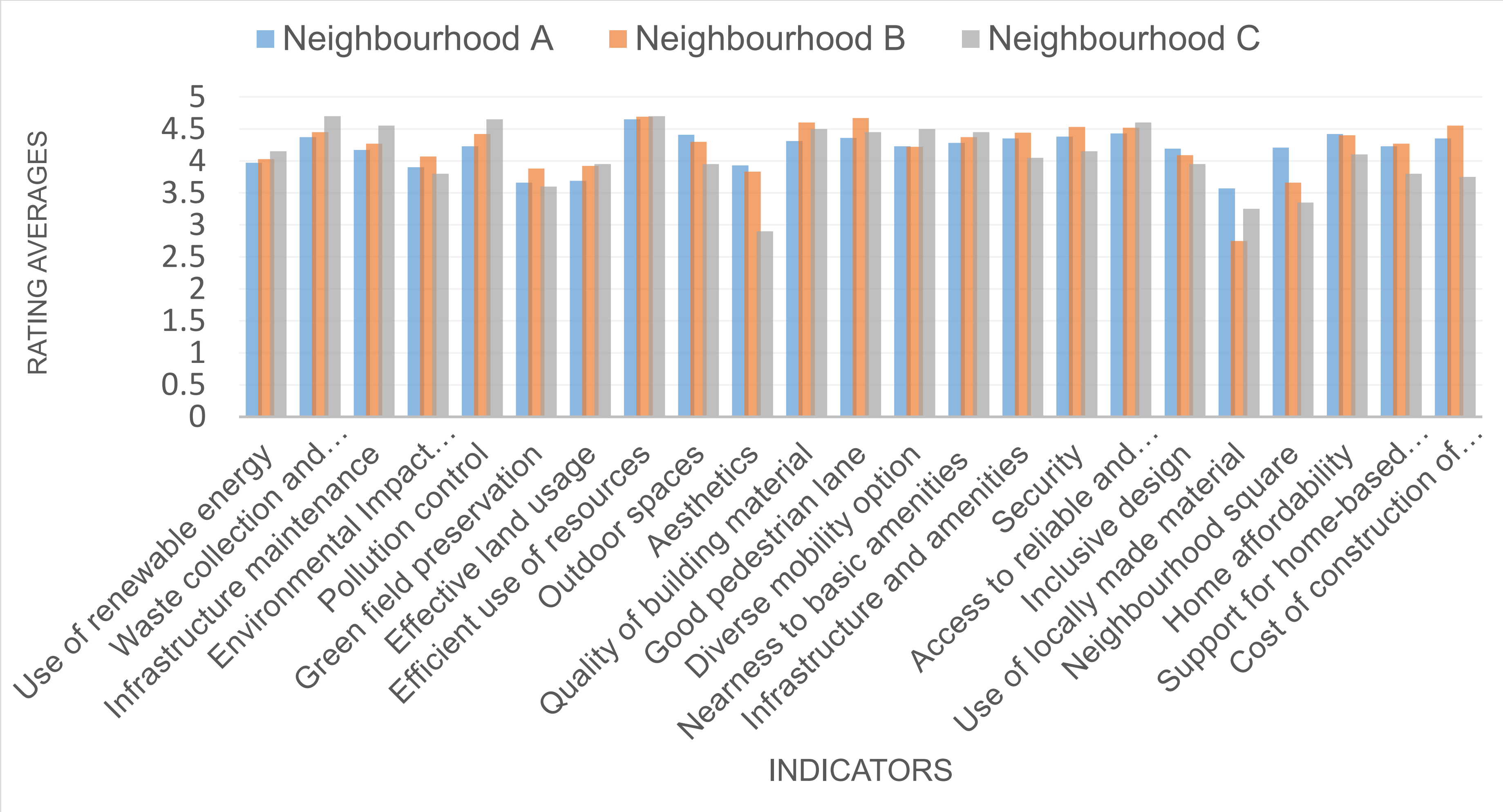

Figure 4. 12: Weighted averages of indicators based on residents' neighbourhood of residence
Source:Author, 2020

- Efficient use of resources had the highest weighted average value in the three neighbourhoods; active frontages was the least ranked in neighbourhood A; use of locally made material in neighbourhood B; and aesthetics in neighbourhood C.

- The importance of ‘waste collection and management’; ‘strategy to maintain infrastructure’; ‘pollution control’; ‘diverse mobility options’; ‘nearness to basic amenities’; and ‘access to reliable and potable water were most emphasised in neighbourhood C (a private estate) when compared to the other neighbourhoods.

- The importance of ‘Efficient of resources; ‘outdoor spaces’; ‘access to potable water’; ‘home affordability’; and ‘support for home-based business’ were emphasised as important in neighbourhood A.

- In neighbourhood B, residents emphasised on ‘quality of construction material’; ‘good pedestrian lane’; ‘security’; ‘support for home-based business’; and ‘cost of construction, operation, and maintenance’ when compared to other neighbourhoods.

Despite the typologies of each of the three neighbourhoods, the following similarities can be established which can be helpful in the decision-making process:

- Waste collection and management had a higher rating and should, therefore, be prioritised when compared to the use of renewable energy; and strategy to maintain infrastructure;

- Pollution control strategy has higher priority than greenfield preservation;

- ‘Security’, and ‘good pedestrian lane’ were perceived to be more important than infrastructure;

- Also, provision of neighbourhood square contributes more to a sustainable neighbourhood than the use of locally-made materials.

Perception across age groups

The weighted averages of the indicators varied across the age-group of respondents (figure 4.13).

- Efficient use of resources was the most important across the groups except for residents above 65 years;

- ‘Access to reliable and potable water’ was perceived to be the second most important by residents in the 18-25 and 25-34 age groups but the most important to residents in the above 65 age group; Residents in the 35-54 and 55-64 age group, however, differ on this because good pedestrian lane was ranked second;

- There was no consensus in the various age groups on some indicators when compared to one another. For example, residents in the age groups ’18-24’; ’35-54’; and ‘above 65’ perceived security to be more important than infrastructure and amenities. Meanwhile, residents in the age groups ’25-34’; and ’55-64’ perceived infrastructure to be more important.

However, the following similarities existed across the various age groups:

- Outdoor space was perceived to be more important than aesthetics;

- Waste collection and management was considered ahead of renewable energy; strategy to maintain infrastructure; and environmental impact assessment;

- Pollution control contributes more to the delivery of a sustainable neighbourhood than greenfield preservation;

- The exclusion of ‘home garden for food’ and ‘active frontage for shops’ was further justified with the weighted average values across the age groups.

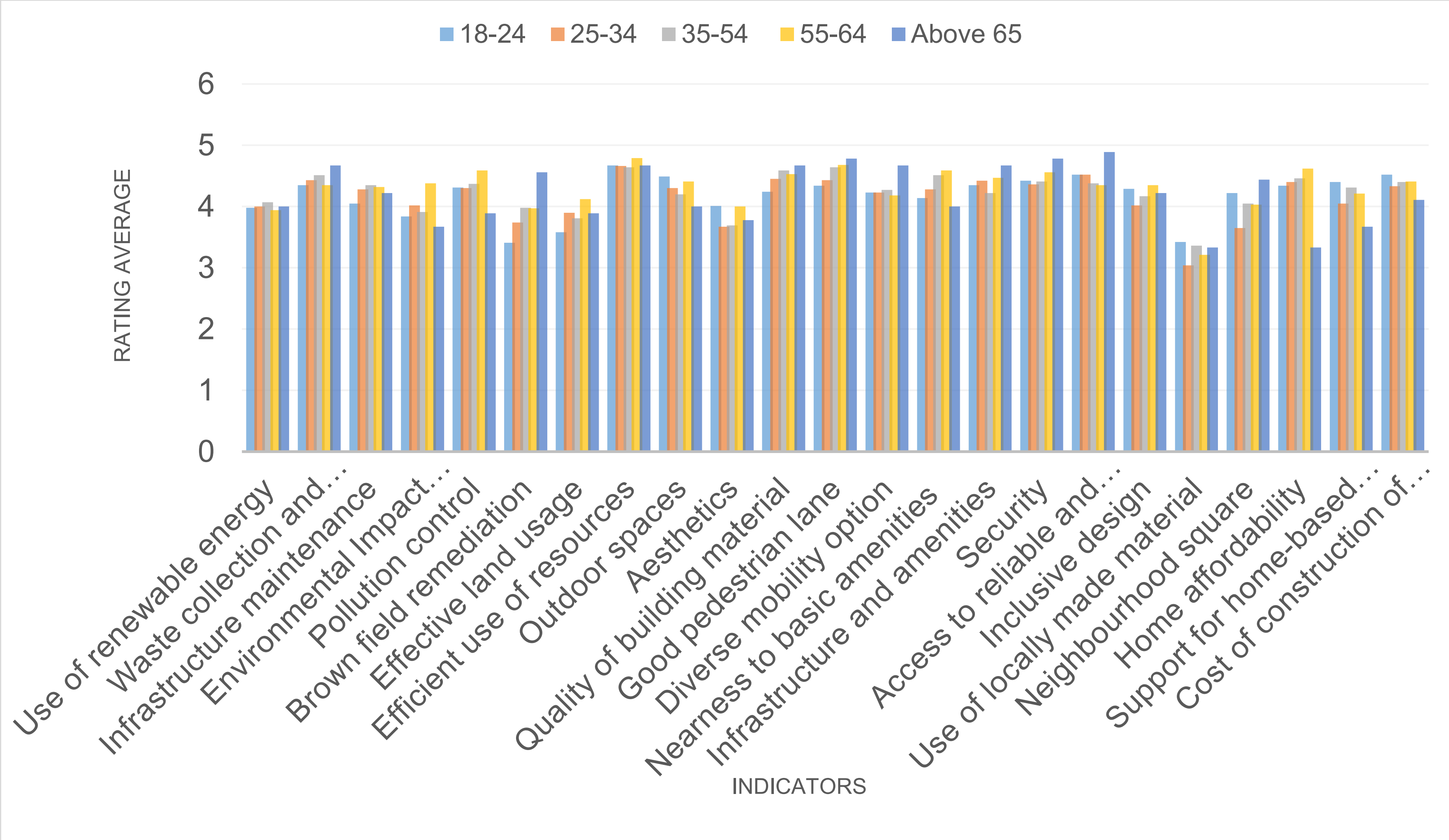

Figure 4. 13: Rating averages of indicators based on residents' age group
Source: Author, 2020

Perceptions across income groups

The weighted average of the indicators varied across the income groups of the respondents (figure 4.14).

- The top 3 indicators in the category of residents below the middle-income group are: ‘cost of construction, operation, and maintenance’ ‘home affordability’; ‘quality of construction material’

- The top 3 indicators in the category of residents in the middle-income group are: ‘efficient use of resources’, ‘good pedestrian lane’; and then ‘waste collection and management’

- The top 3 indicators in the category of residents above middle-income group are: ‘efficient use of resources’, ‘access to reliable and potable water’, and ‘home affordability’

However, there were some consensuses on some of the indicators across the income groups:

- Waste collection and management was perceived to be more important than strategy to maintain infrastructure;

- The quality of construction material was perceived to be more important than the ‘provision of outdoor spaces’

- Home affordability was agreed across the income groups to be important than support for ‘home-based business’

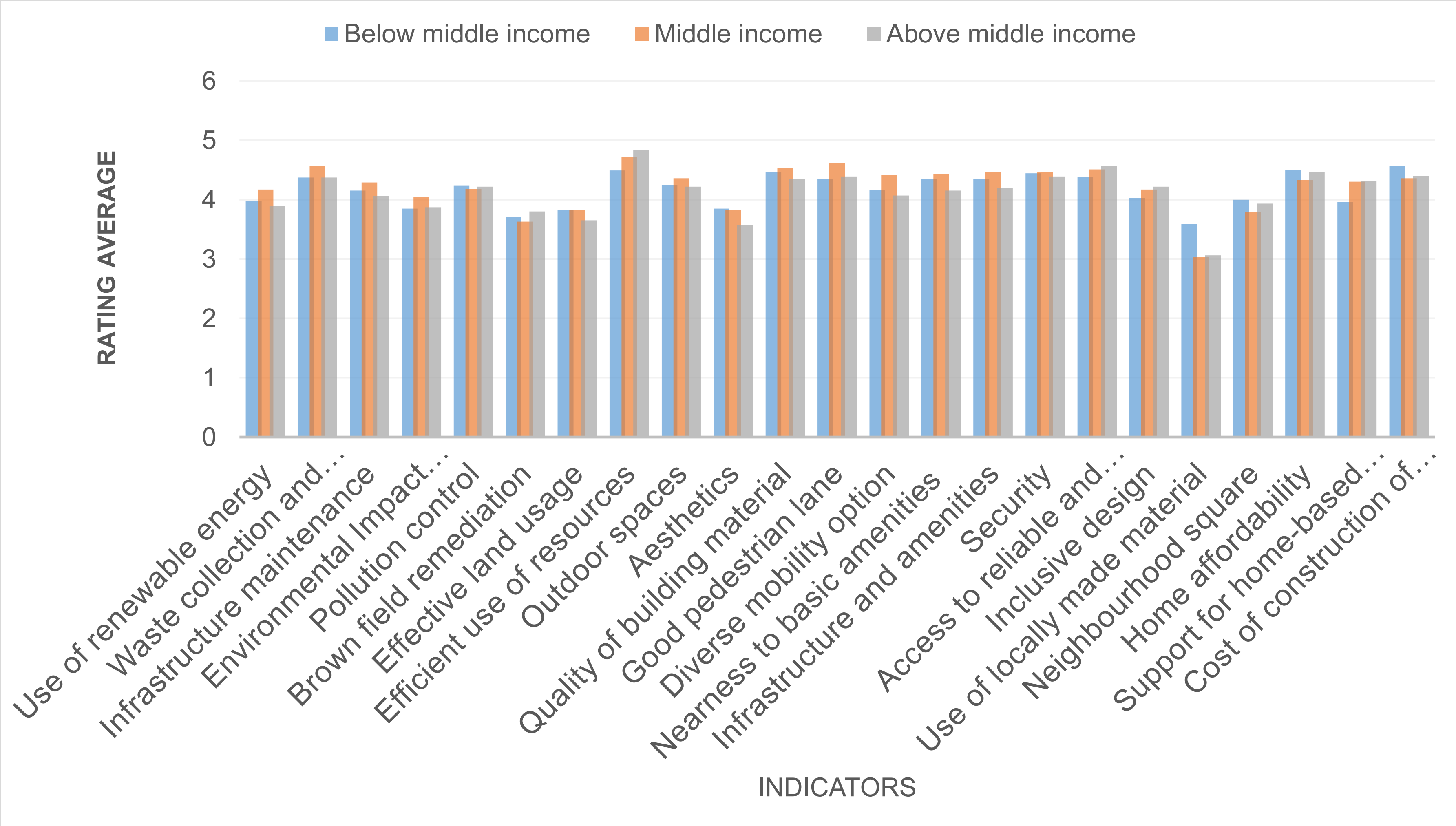

Figure 4. 14: Rating averages of indicators based on residents' income group
Source: Author, 2020

Perception across categories of stakeholders

There were variations in the perceptions of both institutional stakeholders and residents (figure 4.15).

- The top 3 indicators based on the institutional stakeholders' perception are: quality of construction material (4.86); availability of infrastructure and amenities (4.86); good pedestrian lane (4.76); waste collection and management (4.76); and access to potable water (4.71);

- The top 3 indicators based on residents' perception are: efficient use of resources (4.67); availability of infrastructure and amenities (4.64); and good pedestrian lane (4.50);

However, the following similarities existed in the perceptions of both categories of stakeholders:

- Consideration for the cost of construction, operation, and maintenance is more important than home affordability;

- Home affordability was perceived to be more important than support for home-based business;

- Waste collection and management was perceived to be more important than the use of renewable energy;

- Nearness to basic amenities is more important than diverse mobility options;

- Availability of infrastructure and amenities contributes more to a sustainable neighbourhood than security.

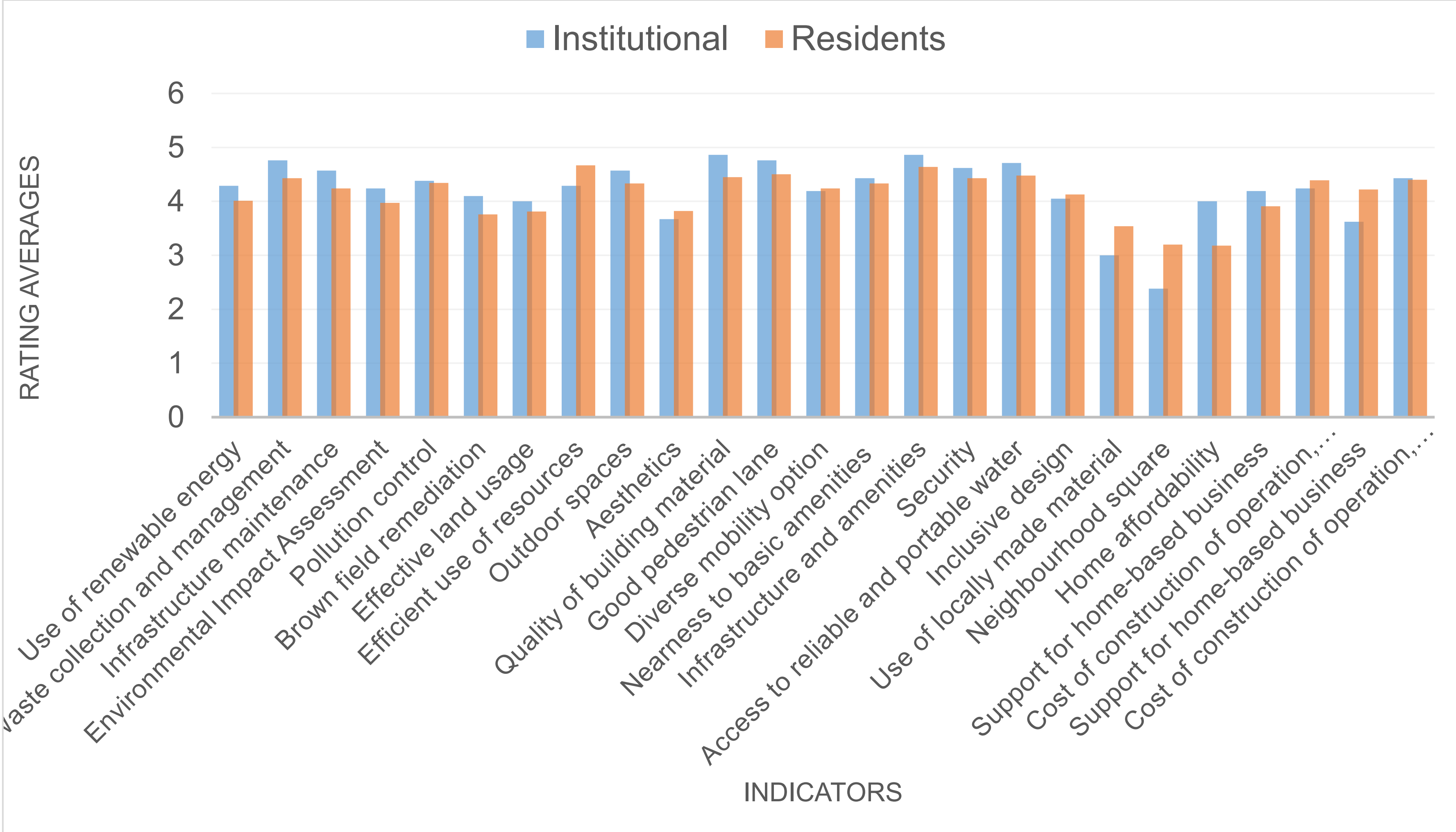

Figure 4. 15: Patterns of institutional stakeholders and residents' perception
Source: Author, 2020

However, the result of the ANOVA test (table 4.8) showed that with p values > 0.05, the null hypothesis that “*both institutional stakeholders and residents have the same perception on sustainability dimensions and indicators”* will not be rejected. This means that there is no statistical justification to conclude, that the perceptions of both categories of stakeholders differ on the sustainability indicators.

However, there was a statistically significant reading in stakeholders’ perception on the ‘use of locally material’ which means that for this indicator the null hypothesis will be rejected. This means that both categories of stakeholders differed to a significant degree in their perceptions on this indicator.

Table 4. 8: The ANOVA test comparing institutional stakeholders and residents' perceptions

Indicators	Institutional (n=21)		Residents (n=3019)		p values
	WA	**SD**	**WA**	**SD**	
Use of renewable energy	4.29	1.44	4.01	1.34	0.357
Waste collection and management	4.76	1.72	4.43	1.51	0.338
Strategy to maintain infrastructure	4.57	1.59	4.24	1.42	0.307
Environmental Impact Assessment	4.24	1.42	3.97	1.33	0.371
Pollution control	4.38	1.49	4.34	1.47	0.904
Green field preservation	4.10	1.37	3.76	1.29	0.245
Effective land usage	4.00	1.34	3.81	1.30	0.518
Efficient use of resources	4.29	1.44	4.67	1.66	0.307
Outdoor spaces	4.57	1.59	4.33	1.46	0.469
Aesthetics	3.67	1.29	3.82	1.30	0.609
Quality of building material	4.86	1.78	4.45	1.53	0.241
Good pedestrian lane	4.76	1.72	4.50	1.56	0.463
Diverse mobility options	4.19	1.40	4.24	1.42	0.876
Nearness to basic amenities	4.43	1.51	4.33	1.46	0.762
Availability of infrastructure & amenities	4.86	1.78	4.64	1.64	0.555
Security	4.62	1.62	4.43	1.51	0.579
Access to reliable and potable water	4.71	1.69	4.48	1.54	0.511
Inclusive design	4.05	1.35	4.13	1.38	0.797
Use of locally made material	4.00	1.34	3.18	1.39	0.009
Provision of neighbourhood square	4.19	1.40	3.91	1.32	0.349
Home affordability	4.24	1.42	4.39	1.49	0.654
Support for home-based business	3.62	1.29	4.22	1.41	0.058
Cost of construction of operation, & maintenance	4.43	1.51	4.40	1.50	0.929

Source: Author, 2020

4.3 Stakeholders’ Preferences for Sustainability Indicators

This section further addresses research objective 3 by establishing stakeholders’ preferences of the indicators in order to assign weight and subsequently rank them.

4.3.1 Weight and Ranking of Sustainability Dimensions

As expected, there were variations in stakeholders’ preferences of the sustainability dimensions. For example, 6 out of the 21 respondents representing 28.57 per cent had an equal preference for each of the dimensions (Table 4.9). That is, each dimension should be given the same priority in the decision-making process of a new neighbourhood. These are participant_21; participant_5; participant_7; participant_18; participant_11; and participant_4.

Table 4. 9: Aggregate result of each participant’s preferences for sustainability dimension

Anonymised name	**Socio-cultural**	**Economic**	**Environmental**
Participant_21	0.333	0.333	0.333
Participant_19	0.717	0.217	0.066
Participant_5	0.333	0.333	0.333
Participant_6	0.143	0.143	0.714
Participant_7	0.333	0.333	0.333
Participant_20	0.078	0.487	0.435
Particpant_15	0.511	0.069	0.420
Particpant_16	0.413	0.327	0.260
Particpant_17	0.260	0.327	0.413
Particpant_18	0.333	0.333	0.333
Particpant_13	0.429	0.429	0.143
Participant_14	0.060	0.231	0.708
Particpant_12	0.511	0.069	0.420
Participant_8	0.327	0.260	0.413
Participant_9	0.075	0.696	0.229
Participant_10	0.020	0.060	0.200
Participant_11	0.333	0.333	0.333
Participant_1	0.250	0.095	0.655
Participant_2	0.429	0.429	0.143
Participant_3	0.200	0.200	0.600
Participant_4	0.333	0.333	0.333
Group result	0.310	0.311	0.379

Source: Author, 2020

However, the aggregate result from the stakeholders' preferences (Table 4.10) showed that the environmental dimension was ranked first with a weight of 0.379; followed by economic (0.311); and socio-cultural (0.310).

Table 4. 10: Ranking of sustainability dimensions based on stakeholders' preferences

Dimensions	Priority value (Weight)	Rank
Environmental	0.379	1
Economic	0.311	2
Socio-cultural	0.310	3
Total	1.000	

Source: Author, 2020

4.3.2 Weight and Ranking of Sustainability Indicators

Aggregated results from each participant showed variations in their preferences of the sustainability indicators (tables 4.11; 4.12; and 4.13). Among the developers, for example, participant_21 and participant_7 gave equal preference for the environmental indicators; participant_19 and participant_20 prioritised impact assessment more than all the indicators; participant_6 and participant_5 prioritised pollution control, and greenfield preservation respectively more than all the indicators. This variation was also observed in the result of other categories of stakeholders.

Table 4. 11: Aggregate of result from each participant on environmental indicators

Anonymised name	Renewable energy	Waste Mgt.	Infrastructure maintenance	Environmental IA	Pollution Control	Green field preservation	Effective land usage	Efficient use of resources
Particpant_21	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
Participant_19	0.105	0.680	0.101	0.374	0.218	0.830	0.180	0.340
Participant_5	0.460	0.460	0.125	0.138	0.101	0.253	0.171	0.149
Participant_6	0.210	0.237	0.300	0.930	0.271	0.300	0.218	0.101
Participant_7	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
Participant_20	0.910	0.720	0.700	0.308	0.272	0.640	0.650	0.570
Particpant_15	0.139	0.152	0.122	0.207	0.610	0.460	0.134	0.139
Particpant_16	0.370	0.480	0.520	0.120	0.141	0.670	0.670	0.468
Particpant_17	0.291	0.122	0.811	0.142	0.320	0.870	0.135	0.110
Particpant_18	0.890	0.760	0.950	0.113	0.102	0.610	0.140	0.450
Particpant_13	0.400	0.157	0.470	0.370	0.650	0.530	0.350	0.233
Participant_14	0.310	0.186	0.960	0.960	0.375	0.410	0.127	0.470
Particpant_12	0.132	0.179	0.113	0.890	0.810	0.176	0.117	0.113
Participant_8	0.111	0.113	0.171	0.660	0.287	0.730	0.820	0.980
Participant_9	0.270	0.980	0.110	0.770	0.830	0.530	0.276	0.276
Participant_10	0.870	0.317	0.440	0.271	0.390	0.760	0.330	0.133
Participant_11	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
Participant_1	0.156	0.179	0.183	0.101	0.890	0.102	0.101	0.870
Participant_2	0.550	0.450	0.165	0.185	0.970	0.200	0.910	0.342
Participant_3	0.102	0.920	0.151	0.189	0.870	0.990	0.145	0.134
Participant_4	0.187	0.720	0.105	0.105	0.120	0.137	0.137	0.137
Aggregate value	**0.98**	**0.128**	**0.116**	**0.169**	**0.135**	**0.900**	**0.107**	**0.158**

Source: Author, 2020

Table 4. 12: Aggregate of result from each participant on socio-cultural indicators

Participants	**Use of locally-made material**	**Neighbourhood square**	**Outdoor spaces**	**Aesthetics**	**Quality of building mat.**	**Pedestrian lane**	**Mobility option**	**Nearness to amenities**	**Security**	**Water supply**	**Inclusive design**	**Amenities & infrastructure**
Particpant_21	0.089	0.104	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.00	0.690
Participant_19	0.710	0.160	0.105	0.680	0.101	0.374	0.218	0.830	0.180	0.340	0.900	0.270
Participant_5	0.142	0.137	0.460	0.460	0.125	0.138	0.101	0.253	0.171	0.119	0.058	0.096
Participant_6	0.054	0.030	0.021	0.237	0.030	0.093	0.271	0.030	0.218	0.101	0.087	0.123
Participant_7	0.047	0.350	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.000	0.086
Participant_20	0.057	0.240	0.091	0.072	0.070	0.308	0.272	0.064	0.065	0.057	0.071	0.130
Particpant_15	0.138	0.760	0.139	0.152	0.122	0.207	0.061	0.046	0.134	0.139	0.099	0.061
Particpant_16	0.090	0.180	0.037	0.048	0.052	0.120	0.141	0.067	0.067	0.468	0.096	0.097
Particpant_17	0.060	0.550	0.291	0.122	0.081	0.142	0.032	0.087	0.135	0.110	0.094	0.129
Particpant_18	0.218	0.480	0.089	0.076	0.095	0.113	0.102	0.061	0.014	0.450	0.082	0.029
Particpant_13	0.080	0.140	0.040	0.157	0.047	0.370	0.065	0.053	0.035	0.233	0.098	0.127
Participant_14	0.029	0.170	0.031	0.186	0.096	0.096	0.375	0.041	0.127	0.047	0.092	0.174
Particpant_12	0.092	0.990	0.132	0.179	0.113	0.089	0.081	0.176	0.117	0.113	0.089	0.064
Participant_8	0.130	0.410	0.111	0.113	0.171	0.066	0.287	0.073	0.082	0.098	0.047	0.110
Participant_9	0.010	0.140	0.027	0.098	0.110	0.077	0.083	0.053	0.276	0.276	0.650	0.117
Participant_10	0.166	0.150	0.087	0.317	0.044	0.271	0.039	0.076	0.033	0.133	0.079	0.054
Participant_11	0.065	0.650	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.000	0.117
Participant_1	0.010	0.140	0.156	0.179	0.183	0.101	0.089	0.102	0.101	0.087	0.066	0.065
Participant_2	0.018	0.170	0.055	0.045	0.165	0.185	0.097	0.020	0.091	0.342	0.077	0.058
Participant_3	0.074	0.240	0.102	0.093	0.151	0.189	0.087	0.099	0.145	0.134	0.087	0.062
Participant_4	0.021	0.420	0.187	0.072	0.105	0.105	0.120	0.137	0.137	0.137	0.035	0.142
Aggregate value	**0.081**	**0.058**	**0.071**	**0.118**	**0.110**	**0.061**	**0.071**	**0.094**	**0.100**	**0.116**	**0.065**	**0.113**

Source: Author, 2020

Table 4. 13: Aggregate of result from each participant on economic indicators

Participants	**Home affordability**	**Support for home-based business**	**Cost of construction, maintenance and operation**
Particpant_21	0.333	0.333	0.333
Participant_19	0.717	0.217	0.066
Participant_5	0.163	0.297	0.540
Participant_6	0.708	0.231	0.060
Participant_7	0.333	0.333	0.333
Participant_20	0.060	0.231	0.708
Particpant_15	0.333	0.333	0.333
Particpant_16	0.333	0.333	0.333
Particpant_17	0.078	0.435	0.487
Particpant_18	0.199	0.068	0.733
Particpant_13	0.200	0.200	0.600
Participant_14	0.064	0.237	0.699
Particpant_12	0.333	0.333	0.333
Participant_8	0.413	0.260	0.327
Participant_9	0.429	0.429	0.143
Participant_10	0.237	0.640	0.699
Participant_11	0.333	0.333	0.333
Participant_1	0.558	0.320	0.122
Participant_2	0.413	0.327	0.260
Participant_3	0.429	0.143	0.429
Participant_4	0.229	0.075	0.699
Aggregate value	**0.324**	**0.278**	**0.398**

Source: Author, 2020

The aggregate values obtained for each indicator is known as the local priority value. This is the weight of the indicator when compared to other indicators under their respective dimensions. However, there is a need to calculate the global priority value which shows the weight of an indicator when compared with other indicators. This was calculated by multiplying the local priority value and the weight of the dimension which it belongs. For example, renewable energy with a local priority value of 0.89 has a global priority value of 0.037 (that is, 0.98 multiply by 0.379). Tables 4.14; 4.15; and 4.16 present the result for other indicators under their respective dimensions.

The reliability of the values was obtained by calculating the consistency ratio (CR). The CRs for the environmental; social-cultural; and economic indicators are 0.004; 0.003; and 0.002 respectively making the data sufficiently reliable and consistent.

Table 4. 14: The global priority value of the environmental indicators

Environmental Indicators	**Weight of indicators**	
	Local priority	**Global priority**
Use of renewable energy	0.098	0.037
Waste collection and management	0.128	0.049
Strategy to maintain infrastructure	0.116	0.044
Environmental Impact Assessment	0.169	0.064
Pollution control	0.135	0.051
Green field preservation	0.090	0.034
Effective land usage	0.107	0.040
Efficient use of resources	0.158	0.060
Total	1.00	0.379

Source: Author, 2020

Table 4. 15: The global priority value of the socio-cultural indicators

Socio-cultural Indicators	**Weight of indicators**	
	Local priority	**Global priority**
Outdoor spaces	0.071	0.022
Use of public arts & landscape elements (Aesthetics)	0.061	0.019
Quality of building material	0.110	0.034
Good pedestrian lane	0.061	0.019
Diverse mobility option	0.071	0.022
Nearness to basic amenities	0.094	0.029
Security	0.100	0.031
Access to potable water	0.116	0.036
Inclusive design	0.065	0.020
Availability of infrastructure & amenities	0.113	0.035
Use of locally made material	0.081	0.025
Neighbourhood squares	0.058	0.018
Total	1.00	0.310

Source: Author, 2020

Table 4. 16: The global priority value of the economic indicators

Economic Indicators	Weight of indicators	
	Local priority	**Global priority**
Home affordability	0.324	0.100
Support for home-based business	0.278	0.087
Cost of construction, operation & maintenance	0.398	0.124
Total	1.00	0.311

Source: Author, 2020

The sustainability index which combines the indicator set is presented in table 4.17

Table 4. 17: The sustainability index showing the aggregate values of the indicator

Dimensions	**Indicators**	**weight**	**rank**
Environmental (0.379)	Environmental Impact Assessment	0.064	4
	Efficient use of resources	0.060	5
	Pollution control	0.051	6
	Waste collection and management	0.049	7
	Strategy to maintain infrastructure	0.044	8
	Effective land usage	0.040	9
	Use of renewable energy	0.037	10
	Greenfield preservation	0.034	11
Social-cultural (0.310)	Access to potable water	0.036	12
	Availability of infrastructure and amenities	0.035	13
	Quality of construction material	0.034	14
	Security	0.031	15
	Nearness to basic amenities	0.029	16
	Use of locally made material	0.025	17
	Outdoor spaces	0.022	18
	Diverse mobility option	0.022	18
	Inclusive design	0.020	20
	Use of public arts and landscape elements (Aesthetics)	0.019	21
	Good pedestrian lane	0.019	21
	Neighbourhood squares	0.018	23
Economic (0.311)	Cost of construction, operation, & maintenance	0.124	1
	Home affordability	0.100	2
	Support for home-based business	0.087	3
		1.00	

Source: Author, 2020

It is noteworthy that there were some similarities in stakeholders' preferences and perceptions. This suggests a reliable consensus of the preference of one indicator over another, which results in a less problematic decision-making process when it comes to prioritising the indicators. For example, the preference for 'waste collection and management' over 'use of renewable energy' and 'strategy to maintain infrastructure'; and 'pollution control' over 'green field preservation' is the same with stakeholders' perception (i) across the three neighbourhoods; (ii) among the institutional stakeholders; and the combined result of residents. The preference for 'quality of construction material' over 'provision of outdoor spaces'; and 'home affordability' over support for 'home-based businesses' align with the perception of institutional stakeholders and residents. Also, the preference for 'cost of construction, operation, and maintenance' over home affordability aligns with the perception of institutional stakeholders and residents.

4.4 Validation of the Indicator Set

The background information of the respondents obtained from the questionnaire is presented in table 4.18 which shows that 77.7 per cent of the respondents have more than 11 years of experience which underpins reliability in their perspectives.

Table 4. 18: Background information of respondents

Institutions and anonymised names	**Role in neighbourhood planning**	**Years of experience**	**No of neighbourhoods involved in**
Ministry of Works (MoW)	Developer (Govt)	Above 20	0-5
Ministry of Housing (MoH)	Developer (Govt)	Above 20	11-20
New Town Development Authority (NTDA)	Regulator	0-5 years	0-5
Ministry of Physical Planning and Urban Development (MPPUD)	Regulator	11-20	11-20
Lagos State Property and Development Corporation (LSDPC)	Developer (Govt)	6-10 years	0-5

Private Developer (PDEV_1)	Developer	11-20 years	0-5
Private Developer (PDEV_2)	Developer	11-20 years	11-20
Lagos Building Investment Company (LBIC)	Regulator	11-20 years	11-20
Lagos Building Control Agency (LABCA)	Regulator	11-20 years	Above 20

Source: Author, 2020

4.4.1 Comprehensiveness, Ranking, and Usability of the Indicator Set

All the institutions agreed on the comprehensiveness, ranking, and usability of the indicator set in addressing sustainability at the neighbourhood level in metropolitan Lagos (table 4.19).

Table 4. 19: Validation of the comprehensiveness, ranking, and usability of the indicator set

Institutions	**Level of agreement (1- strongly disagree 2- disagree 3- neutral 4- agree 5- strongly agree)**		
	Comprehensiveness	**Ranking of indicators**	**Usability**
LSDPC	5	4	4
MoW	5	5	5
NTDA	5	4	5
LBCA	5	5	4
MPPUD	5	5	5
MoH	4	4	4
PDEV_1	4	4	4
LBIC	4	4	4
PDEV_2	5	5	4
Weighted Average	**4.67**	**4.44**	**4.33**

Source: Author, 2020

Explaining further their judgment on the usability and uptake of the sustainability indicators for use in their various institutions in the decision-making process of a new neighbourhood, MoH noted that “the development of sustainable cities and communities is one of the sustainable development goals (SDGs) to which Nigeria is a signatory.” MoW corroborating this position said that “using the indicators in decision-making would ensure the delivery of quality housing to the end-users”. NTDA noted that “the indicators are strongly essential in decision-making for a new neighbourhood because they help to better design a functional neighbourhood and livelihood enhancing factors”. PDEV_1 agreed on the basis that its institution is “receptive to whatever will enhance the goal of affordable housing delivery both in quantity and quality which the indicator epitomises”. LBIC posited that “if the aforesaid indicators are successfully put to use, a sustainable neighbourhood would be built, which would enhance the lives and properties of people”

4.4.2 Barriers to the Uptake of Indicators

Using the 5-point scale, respondents were asked to rate some barriers based on how critical they are to the uptake of the indicators in metropolitan Lagos. The aggregate result (rating average) showed that out of the 13 likely barriers identified, the institutions identified 9 to be critical (which have values equal to or greater than 4.0 on the scale). These are: high cost of implementation; desire by developers to maximise profit; lack of financial schemes for developers; weak enforcement of policies; unavailability of data to implement the indicators; inadequate awareness of sustainability and its benefits; lack of demonstration or sample projects; corrupt practices; and technological know-how and expertise to apply them (figure 4.16).

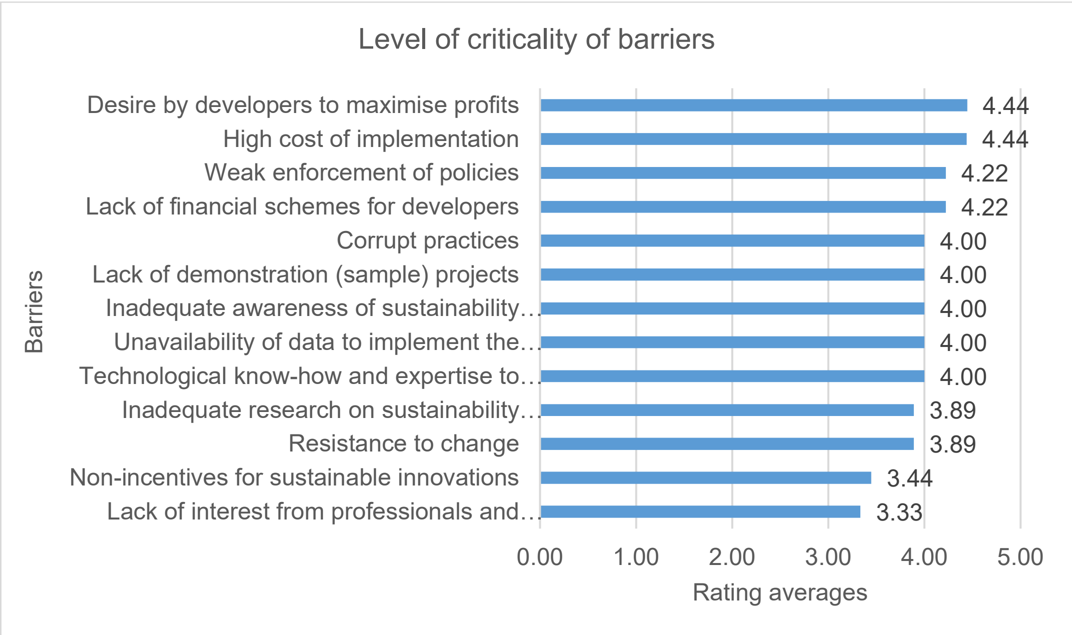

Figure 4. 16: Level of the criticality of the barriers
Source: Author, 2020

The result showed that there was a consensus in the rating of all the 9 critical barriers as the CV values are less than 0.5 (table 4.20). For example, 6 out of the 9 institutions agreed that “high cost of implementation” is a very critical barrier, 2 perceived it as less critical, while only 1 rated it as less critical. Also, 6 institutions noted “inadequate awareness of sustainability and its benefits” as critical; 2 perceived it as very critical; while 1 institution rated it as less critical. Although not a critical barrier, the institutions did not reach a consensus on “lack of interest from professionals and market demand”. 3 perceived it to be less critical; 2 were neutral; 2 agreed that it is critical; while the other 2 believed it is very critical.

Table 4. 20: The variance, standard deviation, and coefficient of variation values of barriers

Barriers	WA	SD	CV
High cost of implementation	4.44	1.52	0.34
Desire by developers to maximise profit	4.44	1.52	0.34
Lack of financial schemes for developers	4.22	1.41	0.33
Weak enforcement of policies	4.22	1.41	0.33
Unavailability of data to implement the indicators	4.00	1.34	0.33
Inadequate awareness of sustainability & its benefits	4.00	1.34	0.33
Lack of demonstration or sample projects	4.00	1.34	0.33
Corrupt practices	4.00	1.34	0.33
Technological know-how & expertise to apply them	4.00	1.34	0.33
Resistance to change	3.89	1.31	0.34
Inadequate research on sustainability indicators	3.89	1.31	0.34
Non-incentives for sustainable innovations	3.44	1.31	0.38
Lack of interest from professionals and market demand	3.33	1.34	0.40

Source: Author, 2020

In proffering solution to the barriers, LBIC suggested that it involves “ensuring the cost of executing aspects of works are not expensive”. In similar words, MoH recommended “some form of subsidy to be provided by the government to bring the cost down”. LABCA was of the view that attitudinal change from all stakeholders is crucial especially from developers to comply with Government policies in the adoption of the indicators. These barriers according to PDEV_1; LBIC can be addressed by intensification in the areas of awareness through regular and consistent seminars, workshops, and conferences”. LSDPC posited that some of the key barriers can be addressed by “a strong will power by all stakeholders and the society to seek and work at achieving sustainability”.

In terms of how the indicator can fit into existing framework for physical planning, MoW and PDEV1 suggested adequate legislation with an effective feedback system, so that at the planning, design, and approval stages, the indicators are used as a reference point for works to be done. In the view of MoH, “political will on the part of the government is critical”.

In closing, MoW agreed that the immediate uptake of the indicators for decision-making at the neighbourhood level is timely and would be beneficial in order to forestall a chaotic city. NTDA corroborated this, that such sustainable neighbourhood model would herald a new paradigm in metropolitan Lagos as it will not only be helpful for new developments but would also provide a framework for re-evaluating existing developments. Also, supporting this view, PDEV_1 posited although there may be initial resistance, “sustainable development is the way to go considering the overwhelming merits that it brings to the table”. LSDPC, however, posited such sustainable neighbourhoods can only be profitable in the nearest future because “stakeholders (both developers and homeowners) at the moment only desire profit irrespective of whether or not it is sustainable”

4.5 Characteristics of Indicator Set

This section builds on the results and findings to explore the characteristics of the indicator set as summarised in figure 4.17 using the various approaches that the indicators can be described as previously reviewed in section 2.8.

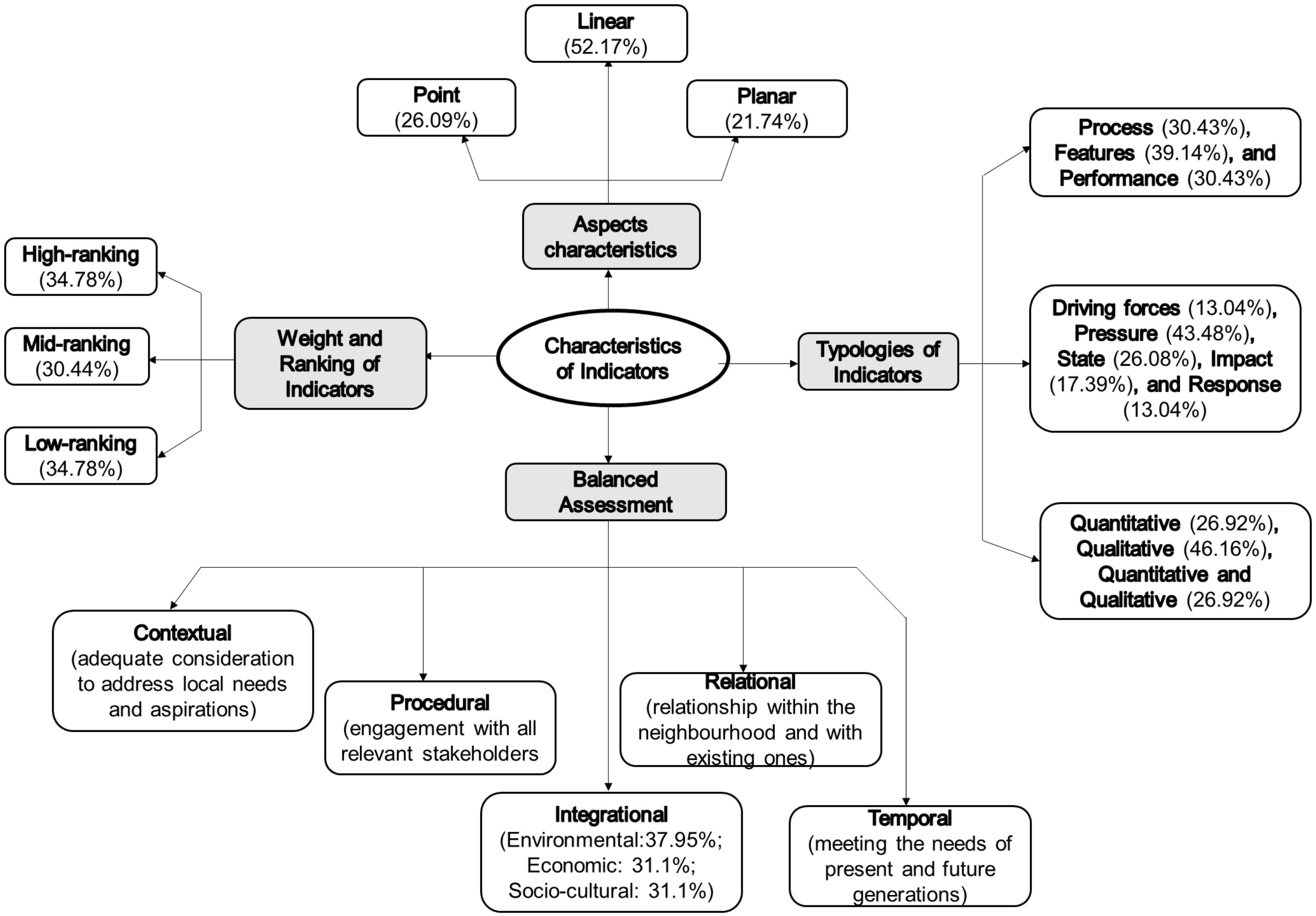

Figure 4. 17: Framework for characterising the indicators of a NSAF
Source: Author, 2020

4.5.1 Balanced Assessment

This assesses the characteristics of the indicator set using the following five criteria of contextual, procedural, integrational, relational, and temporal.

In terms of contextual balance which describes the indicator set from the perspective of consideration for contextual issues, the indicator set reflects consideration for liveability which seems to be a pressing need considering the state of neighbourhoods in metropolitan Lagos. Out of the 23 indicators, the uptake of 5 could contribute directly to the delivery of liveable neighbourhoods. These are: access to potable water; availability of infrastructure and amenities; security; outdoor spaces; and good pedestrian lane.

The indicator set is also characterised with procedural balance because there was an engagement with the relevant stakeholders in its development and validation for use. The indicator set was a product of the responses from both institutional stakeholders and residents in metropolitan Lagos. This was important to ensure that values, aspirations, and needs of all stakeholders are captured. This is a distinguishing characteristic when compared with the development process of existing NSAFs which were developed mainly by selected experts with no input from the public. The weighing and ranking of the indicator set show an integrational balance and distribution across the dimensions of sustainability. Environmental was allocated 37.95 per cent; Economic 31.1 per cent; and Socio-cultural 31.0 per cent. It indicates that the indicator set by its formulation enhances a comprehensive and holistic consideration of sustainability.

The relational characteristics of the indicator set can be explained on two fronts. One, within the neighbourhood, the uptake of the “social amenities and infrastructure” indicator, requires a detailed spatial analysis of the amenities to be provided with information of the capacity. Also, “diverse mobility options” requires a mobility plan showing the layout and design of streets which promotes sustainable modes of transportation. Two, the indicator set also addresses the relationship with and consideration for existing neighbourhoods. The “social amenities and infrastructure” indicator requires evidence of a survey of existing neighbourhoods to know which facilities would be required for the proposed neighbourhood. Besides, one of the assessment criteria for “inclusive planning and design” is the evidence of consultation with necessary stakeholders (e.g. local authority; residents or community representative of the existing neighbourhood) in the design of the neighbourhood.

For temporal balance which addresses intergenerational and intragenerational equity (that is, consideration for present and future needs), the water treatment plan which is one of the assessment criteria under “access to potable water” is to ensure that while the needs of the current residents are met, the opportunity for future residents is not compromised. Also, the evidence of actions to minimise and not to exceed consumption targets as one of the criteria for “efficient use of resources” is also to ensure that the needs of future generations are met. This characteristic helps to ensure the sustenance of the neighbourhood as progress can also be monitored intermittently.

4.5.2 Typologies

The characteristics of the indicators were explored by mapping the indicators on the DPSIR framework (Figure 4.18).

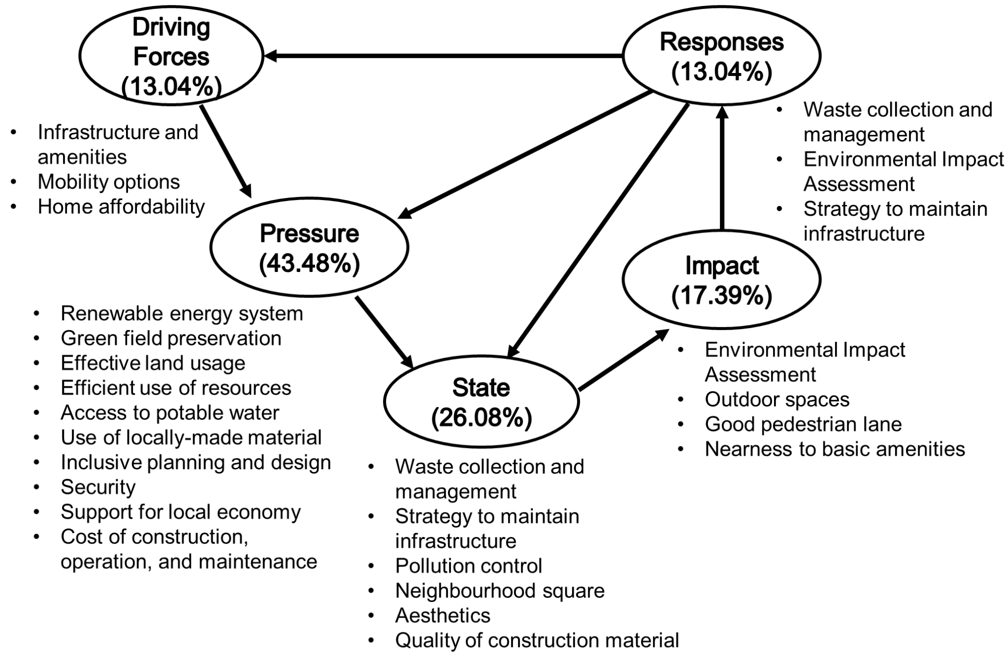

Figure 4. 18: Description of the indicators using the DPSIR framework
Source: Author, 2020

3 (13.04 per cent) of the indicator set can be described as ‘driving forces indicators (D)’. These are to meet the demand for: more eco-friendly means of movement; good living condition; and to address the current housing deficit in metropolitan Lagos respectively. 10 (43.48 per cent) can be described as ‘pressure indicators (P)’. 6 (26.08 per cent) of the indicator set can be described as ‘state indicators (S)’ to ensure that the state and quality of the environment are not compromised in the decision-making process of a new neighbourhood. For instance, having an efficient waste collection and management strategy would contribute significantly to the state of the neighbourhood by ensuring a clean and hygienic neighbourhood with no threat to human health. 4 (17.39 per cent) of the indicator set can be described as ‘impact indicators (I)’. For instance, the provision of outdoor spaces and a friendly pedestrian lane is crucial to enhance healthy living. Also, the environmental impact assessment is to minimise the likely impact of new development on the quality of the environment. However, 3 (13.04 per cent) of the indicator set earlier discussed can still further be described as ‘response indicators (R)’. These are environmental impact assessment; waste collection and management; and strategy to maintain infrastructure.

In addition to the DPSIR, the characteristics of the indicator set were further explored using the types of indicators in NSAF espoused by Wangel et al. (2016).

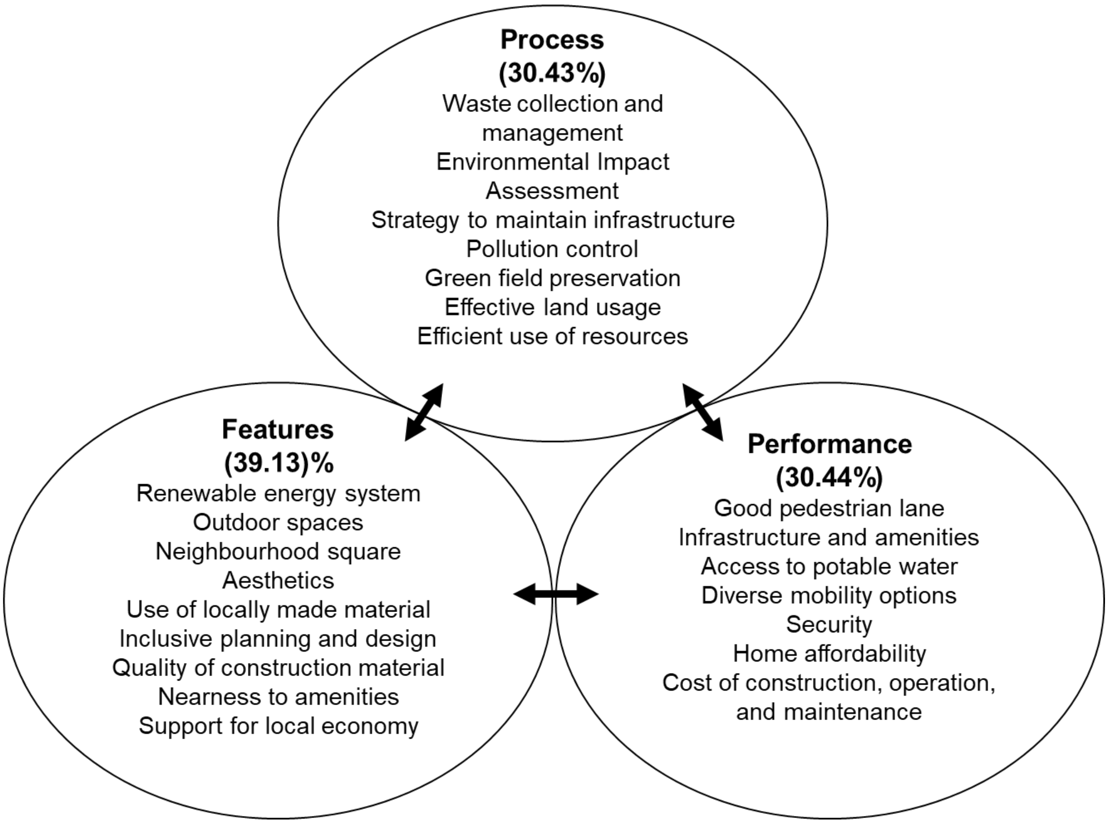

Figure 4. 19: Description of the indicators using indicator types of an assessment framework
Source: Author, 2020

Out of the 23 indicators, 7 (30.43 per cent) are process indicators which represent specific actions, activities, or considerations that could contribute to the delivery of sustainable neighbourhoods. It is noteworthy that the implementation of any of these indicators is not the final product but a phase to lead to the desired outcome. 9 (39.13 per cent) are features indicators which are certain components, or technology that could enhance the delivery of a sustainable neighbourhood. 7 (30.44 per cent) are performance indicators which captures the final output of implementing both process and features indicators.

However, some of these indicators by their assessment criteria can have overlap across the three classifications. For example, inclusive planning and design discussed as a feature indicator can also be a process indicator as it also involves engagement with key and relevant stakeholders in the design process. Also, diverse mobility option can also be explained as a feature indicator in addition to telling how a neighbourhood performs in terms of its transportation options.

Overall, the indicator typologies help to understand the linkages in the sustainability index and their interconnected roles in contributing to the planning and delivering of a sustainable neighbourhood. This is because, a sustainable neighbourhood can not be delivered by feature indicators only as process and performance indicators also play crucial roles in contributing to the sustainability of the neighbourhood.

Furthermore, the characteristics of the indicator set in terms of how they can be assessed in a proposed development either in quantitative or qualitative terms or both were explored. The selected indicators can be described in both qualitative and quantitative terms. 7 (26.92 per cent) of the indicators are quantitative; 12 (46.16%) are qualitative, and 7 (26.92 per cent) can be both quantitative and qualitative (table 4.21).

Table 4. 21: Description and measurement of the indicators

Indicators	Qualitative	Quantitative
Social amenities and infrastructure e.g. clinics, schools etc	quality of infrastructure and amenities	number of amenities and infrastructure to ensure the adequacy
Access to potable water		Number of houses with access to potable water Estimated travel time to the nearest water source
Diverse mobility options	quality of available mobility options	Number of different transportations means
Nearness to social amenities and infrastructure		Distance and travel time to existing and proposed amenities and infrastructure
Strategy to maintain infrastructure	Evidence of a plan to maintain the infrastructure	

Inclusive planning and design	Quality of stakeholder engagement in decision-making Consideration for the physically challenged planning	
Friendly pedestrian lane	Quality of pedestrian lane/route and associated	
Quality of construction material	Quality of construction material against the standard for construction	
Pollution control strategy	level of consideration given to the prevention of noise, air, and water pollution in the planning and design of the neighbourhood?	
Environmental Impact Assessment	Detailed and quality EIA report	
Waste collection and management	Quality of waste collection infrastructure	Percentage of wastes to re-used and recycled during construction and during operation of the neighbourhood
Use of renewable energy systems		Quantity and percentage of electricity generated by renewable energy Number of households powered by renewables
Provision of outdoor spaces	Quality of outdoor spaces and buildings	Adequacy of outdoor spaces with an expected population
Security of lives and properties	Quality of security measures in place	
Neighbourhood square	Quality and access to the neighbourhood scale	

Support for home-based business	Level of support the planning and design of the neighbourhood give to home-based	
Cost of construction, operation, and maintenance		The estimated building, operation, and maintenance cost of the neighbourhood
Home affordability		Percentage distribution of dwellings to accommodate various income groups Percentage distribution of ownership schemes and options
Efficient use of resources	Demonstration of how resources have effectively been used	
Greenfield preservation		Percentage of green-field to be used
Effective land usage	Level of consideration of efficient land usage in the planning and design stages	Percentage of unused land for future expansion
Use of locally-made material		Percentage of building materials that are locally made and sourced
Aesthetics (public arts and landscape etc)	Level of consideration for aesthetics with the use of public arts and landscape elements	

Source: Author, 2020

4.5.3 Ranking

Out of the 23 indicators, high-ranking indicators with a weight greater than 0.040 are: Cost of construction, operation, and maintenance (0.123); Home affordability (0.100); Support for home-based business (0.087); Environmental Impact Assessment (0.064); Efficient use of resources (0.60); Pollution control (0.051); Waste collection and management (0.049); and Strategy to maintain infrastructure (0.044).

The mid-ranking indicators with weight equal and less than 0.040 but greater than 0.029 are: Effective land usage (0.040); Use of renewable energy (0.037); Greenfield preservation (0.034); Access to potable water (0.036); Availability of infrastructure and amenities (0.035); Quality of construction material (0.034); and Security (0.031).

The low-ranking indicators with weight equal and less than 0.029 are: Nearness to basic amenities (0.029); Use of locally made material (0.025); Outdoor spaces (0.022); Diverse mobility option (0.022); Inclusive design (0.020); Use of public arts and landscape elements (0.019); Good pedestrian lane (0.019); and Neighbourhood Squares (0.018).

Each of the high-ranking and low-ranking indicators represents 34.78% of the indicator set while mid-ranking represents 30.44%.

4.5.4 Aspect

The aspect characteristics of the indicator were further explored as illustrated in figure 4.20

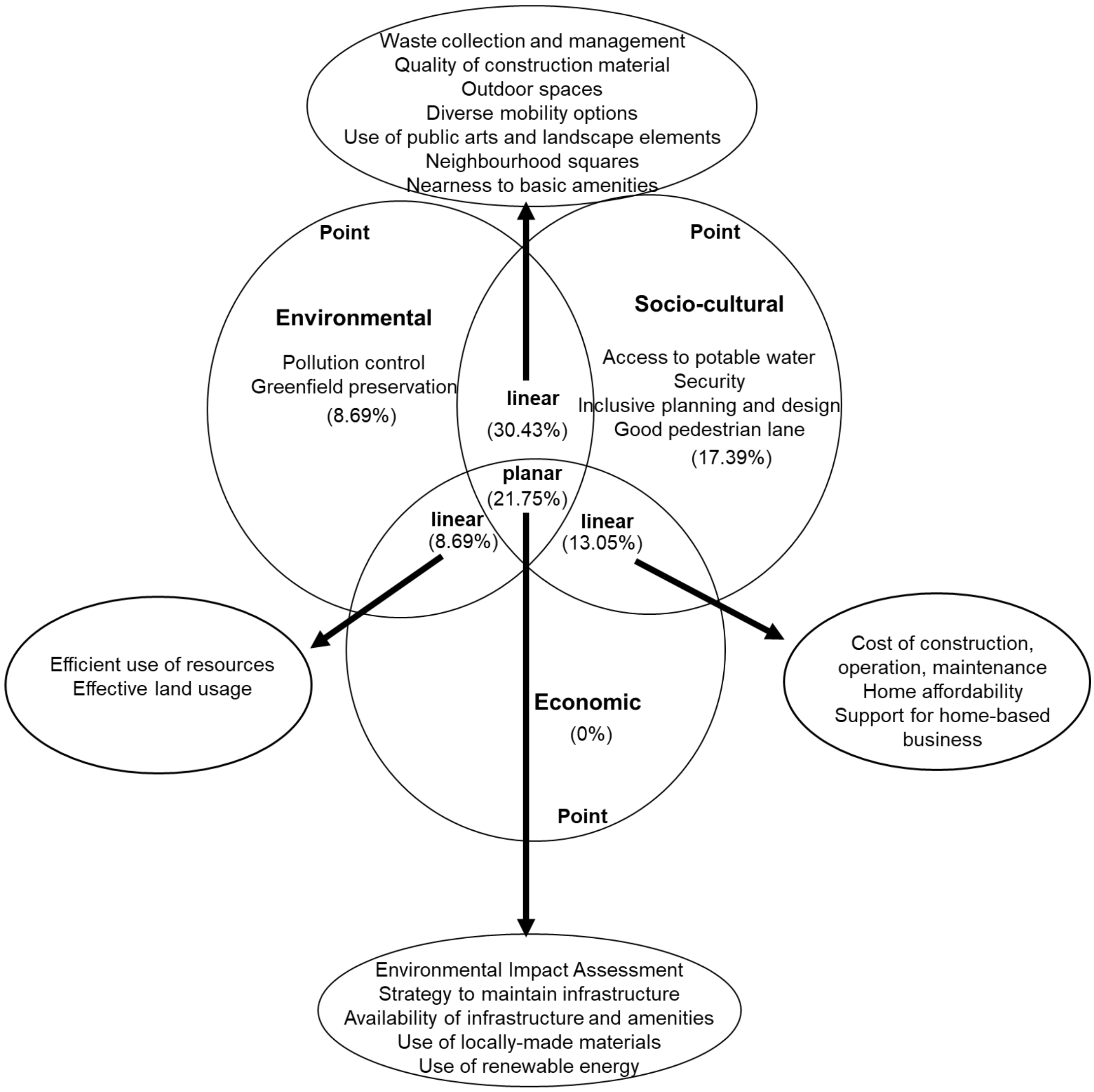

Figure 4. 20:The aspect characteristics of the indicator set
Source: Author, 2020

6 (26.09 per cent) of the indicators can be described under the point aspect (that is, of belonging to only one dimension). These are pollution control (Env); greenfield preservation (Env); access to potable water (Sc); security (Sc); inclusive planning and design (Sc); and good pedestrian lane (Sc).

12 (52.18 per cent) of the indicators can be described under the linear aspect belonging to two dimensions. These are efficient use of resources (Env and Ec); waste collection and management (Env and Sc); effective land usage (Env and Ec); quality of construction material (Sc and Env); nearness to basic amenities (Sc and Env); outdoor spaces (Sc and Env); diverse mobility options (Sc and Env); use of public arts and landscape elements (Sc and

Env); neighbourhood squares (Sc and Env); cost of construction of operation, and maintenance (Ec and Sc); home affordability (Sc and Ec); and support for home-based business (Sc and Ec).

5 (21.73 per cent) of the indicators can be discussed under the three dimensions (Sc, Env, and Ec) in what is known as the planar aspect. These are environmental impact assessment; a strategy to maintain infrastructure; availability of infrastructure and amenities; use of locally-made materials; use of renewable energy.

Overall, the characteristics of the indicator set shows environmentally-focused indicators (Env) account for 8.69 per cent of the indicator set; Social (Sc): 17.39 per cent; Economic (Ec): 0; Environmental and economic (Env-Ec): 8.69 per cent; Environmental and social (Env-Sc): 30.43 per cent; Social and economic (Sc-Ec): 13.05 per cent; and Environmental, Economic, and Social (Env-Ec-Sc): 21.75 per cent (figure 4.21)

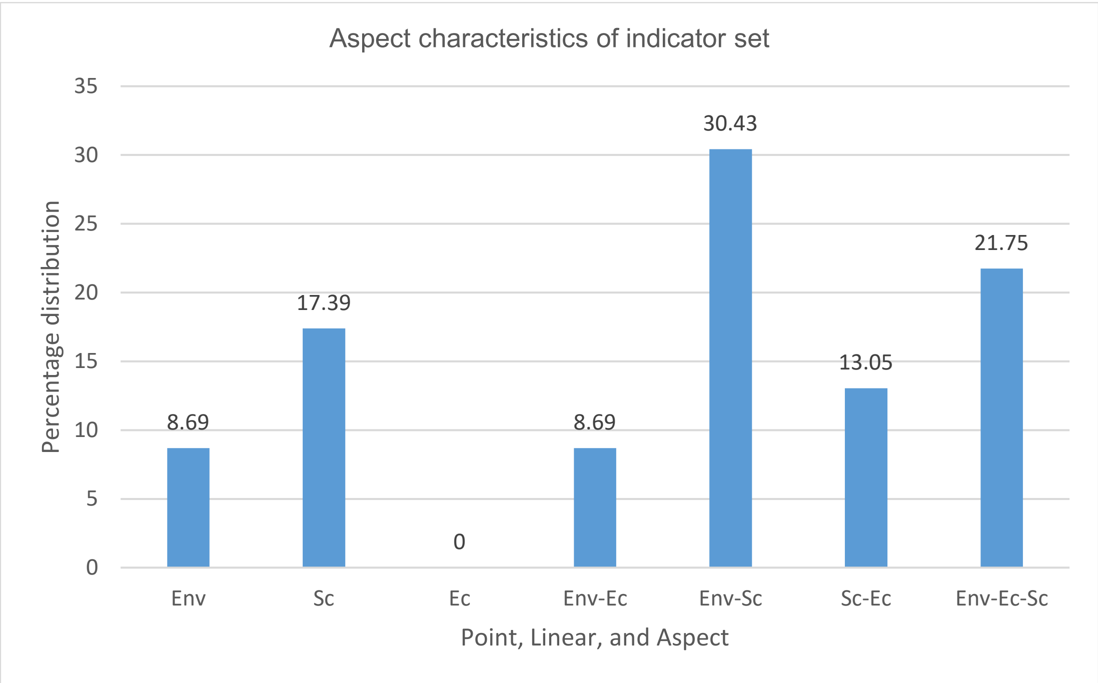

Figure 4. 21: Aspect characteristics of the indicator set
Source: Author, 2020

4.6 Summary

On the understanding of the sustainable neighbourhood concept, the analysis of results from the various institutional stakeholders showed: (i) agreement with established ideas of the concept in term of meeting the needs of the present without compromising the ability of future generations to meet their own needs; (ii) variations and complexities in the understanding among the stakeholders, although most of the stakeholders perceived the concept from the angle of liveability; (iii) two main dominant themes of "infrastructure and maintenance" and "liveability and security" emerged across the stakeholders as to what defines a sustainable neighbourhood. These main findings from this objective are further highlighted.

Stakeholders' understandings of a sustainable neighbourhood spread across the themes that emerged from the literature, suggesting a close overlap. Also, most definitions from the stakeholders have 2 or more themes. For example, ACAD3's definition reflects economic growth, cultural values, and infrastructure (figure 4.22).

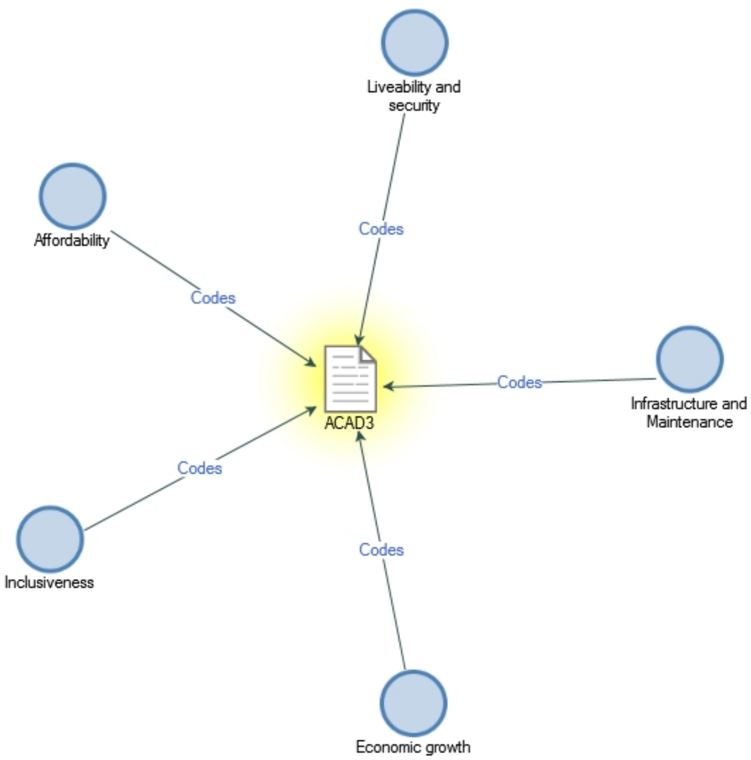

Figure 4. 22: ACAD3 understanding of a sustainable neighbourhood
Source: Author, 2020

However, compliance with building regulations emerged as a new theme which is to ensure that the neighbourhood meets required standards and that illegal structures are not built. This is more important than ever before due to the recent consequences of non-compliance to planning regulations such as increased rate of building collapse among others.

There were complexities in the stakeholders' understanding as evident in the variation in the results from each of the categories of the stakeholders. The four regulatory agencies (LABCA; LASPDDA; NTDA; and MPPUD) differ in their understanding of a sustainable neighbourhood. For instance, the New Town Development Authority (NTDA) defined a sustainable neighbourhood from the lens of availability of infrastructure and setting up a management framework for routine maintenance. Meanwhile, the Lagos State Physical Planning and Development Authority (LASPPDA) considered a neighbourhood to be sustainable by the function of its liveability and support for the local economy. The Ministry of Physical Planning and Urban Development (MPPUD) understood a sustainable neighbourhood as that which would be able to accommodate the projected number of people while Lagos Building Control Agency (LABCA) suggested that such neighbourhood should meet the need of both present and future generations and at the same time ensuring efficient use of energy. Similarly, "infrastructure and maintenance" had the highest frequency of 341 (43.66 per cent) from the results of residents' perception of a sustainable neighbourhood which was followed by 'liveability and security' accounting for a frequency of 294 (37.61 per cent) These findings emphasise the importance of these sustainability aspects in describing a neighbourhood that can be considered in metropolitan Lagos.

Analysis of the results from stakeholders' perception of sustainability indicators led to the selection of 23 indicators from the 25 identified from the literature. Home garden for food; and active frontage for shops were excluded due to their coefficient of variation (CV) and content validity ratio (CVR) values. Results showed variation and similarities in stakeholders' perception of some sustainability indicators. The stakeholders' preferences of the indicators were also captured to assign a weight to the indicators under the different dimensions where they can best be explained from which they were ranked. The cost of construction, operation, and maintenance was ranked first in the indicator set while neighbourhood square was ranked lowest. The sustainability index which forms a key part of the assessment framework is to guide in the decision-making process of a new neighbourhood on how indicators should be prioritised, while also allowing a proposed neighbourhood to be assessed and scored using the sustainability index. Prior to the actual construction of a neighbourhood, it can be assessed on a scale of 0 to 1. For instance, a neighbourhood with a score of 0.8 indicates adequate consideration of sustainability issues in the planning and design; and operation stages of the neighbourhood.

Analysis of the results from the validation of the indicator set showed a high level of agreement amongst the institutions on the content, ranking, and usability of the indicators. On these validation criteria, none of the institutions disagreed. Consequently, the following positions emerged from the submissions of the institutions about the adoption of the indicators for use in planning new neighbourhoods in metropolitan Lagos. One, it would serve as a guide to achieve and deliver the sustainable development goal (SDG) at the neighbourhood level. Two, it would help in the delivery of quality housing developments that are functional where the dignity of man is restored. Three, it would promote the goal of affordable housing which is of necessity in the growing urban population currently being experienced in metropolitan Lagos. The institutions identified 9 critical barriers envisaged to the uptake of the indicators in the decision-making window of a new neighbourhood. It is noteworthy that three of the barriers are cost-related. These are: high cost of implementation, the desire by developers to maximise profits, and lack of financial schemes for developers. Two, which include weak enforcement of policies, and unavailability of data to implement the indicators are government-related. Four of the barriers are human and market-related. These include: corrupt practices, lack of demonstration projects, inadequate awareness on sustainability and its benefits, and inadequate technological know-how and expertise. However, the institutions agreed that the uptake of the indicators is timely and beneficial now taking into consideration the benefits of a sustainable neighbourhood for the growing population of metropolitan Lagos.

These preliminary findings lay the foundation to explore the characteristics of the indicator set using the criteria of: balanced assessment; aspects; typologies; measurability (quantitative or qualitative); and ranking. A glance at the table 4.22 which summarises the characteristics of the indicator gives detailed information about the character of an indicator from the indicator set. For example, it shows that 'outdoor spaces' is a 'low-ranking', 'response', and 'feature' indicator with a 'linear aspect characteristics' (Env-Sc) which can be measured in both 'quantitative and qualitative terms'.

Overall, in terms of a balanced assessment, the indicator set addresses contextual issues that are peculiar to metropolitan Lagos. This is evident with such indicators like access to potable water, good pedestrian lane, and outdoor spaces. Furthermore, the indicator set was also comprehensive in taking a holistic view of sustainability issues thereby attaining integrational balance which would be useful at the decision-making process of a new neighbourhood. It also noteworthy that the indicator set was characterised with consideration for: (i) relationship with the existing neighbourhood; and (ii) needs of both present and future generations. The indicator set was also characterised using different typologies of indicators. Using the DPSIR for example, pressure indicators dominated the indicator set accounting for 43.48% followed by state indicators (26.08%). This is expected for a rapidly growing city like metropolitan Lagos where there is a lot to do to address the associated sustainability challenges of increased pressure on the few infrastructure amenities which has resulted to a deplorable state of the environment.

The characteristics of the indicators as either process, features, or performance indicators help to under the phase of development that the indicators are to be implemented, and where relevant stakeholders are to be engaged. For example, strategy to maintain infrastructure as a process indicator is one of the key procedures which needs to be considered at the various phases of the new development. It can also be observed that the indicators were fairly distributed across the three types. The characteristics of the indicators in terms of their ranking was further explored to establish the priority levels of the indicators in the decision-making process. The aspect characteristics help to understand the linkages between the indicators and how the uptake of one of the indicators could help to deliver other dimensions of sustainability. For example, indicators that exhibit planar characteristics could indirectly help to achieve an element of environmental, economic, and socio-cultural dimensions of sustainability.

Table 4.22: Summary of the characteristics of the indicator set

Indicators	**Characteristics of Indicator Set**																				
	Typologies								**Aspects**							**Ranking**			**Measurability**		
	D	**P**	**S**	**I**	**R**	**Perf.**	**Feat.**	**Proc.**	**Env**	**Sc**	**Ec**	Env-Ec	Env- Sc	Sc-Ec	Ec-En-Sc	H	M	L	Qual	Quan	Qual-Quan
Environmental Impact Assessment				●	●			●							●	●			●		
Efficient use of resources		●						●				●				●			●		
Pollution control			●					●	●							●			●		●
Waste collection and management			●		●			●					●			●					●
Strategy to maintain infrastructure			●		●			●							●	●			●		
Effective land usage		●						●				●					●				●
Use of renewable energy		●					●				●				●		●			●	
Greenfield preservation		●						●	●								●			●	
Access to potable water		●				●				●							●			●	
Infrastructure and amenities	●					●									●		●				●
Quality of construction material			●				●						●				●		●		
Security		●				●				●							●			●	
Nearness to basic amenities				●			●						●					●		●	
Use of locally made material		●					●								●			●		●	
Outdoor spaces				●			●						●					●			●
Diverse mobility option	●					●							●					●			●
Inclusive planning and design		●					●			●								●	●		
Aesthetics			●				●						●					●	●		
Good pedestrian lane				●		●				●								●	●		
Neighbourhood squares			●				●						●					●	●		
Cost of constru operation maint.		●				●								●		●					●
Home affordability	●					●								●		●					●
Support for home-based business		●					●							●		●			●		

Source: Author, 2020

CHAPTER 5 DISCUSSION

This chapter discusses the results, presenting the significance and implications arising from this study, drawing similarities and differences with the existing body of knowledge, whilst also highlighting emerging issues. This discussion covers from the significance of the characteristics of the identified set of potentially useful indicators of a NSAF for metropolitan Lagos, to indicate understandings of a sustainable neighbourhood. It attempts to understand how the context-specificity of metropolitan Lagos influences the characteristics of the indicator set. In terms of structure, the first section addresses the nuances and complexities around the understanding of the term neighbourhood sustainability, and its context-specific indicator set; the second discusses the issues from the characteristics of the indicator set; the third discusses how critical realism was helpful in interpreting the findings; and the fourth highlights the theoretical and practical contributions of the study. In particular, how the insight on characteristics of the indicators can help promote the delivery of urban sustainability in Lagos, via more sustainable neighbourhoods is presented. Areas for future research are identified in the fifth section based on the limitations of this study and the insights derived.

5.1 Complexities in Stakeholders' Understanding

Findings from the study showed the diversity and variations in stakeholders' understanding of the sustainable neighbourhood concept which highlights the complexity and brings challenges to the decision-making process in planning for a sustainable neighbourhood. The complexity here is understood as the difficulty and intricacy in arriving at a consensus definition of a sustainable neighbourhood in metropolitan Lagos. It raises the concern of what it means to deliver a sustainable neighbourhood in metropolitan Lagos in a way that would capture these different perspectives. This complexity in the definition of a sustainable neighbourhood further grounds the need for a collaborative approach and more engagement with stakeholders in the decision-making process of a new neighbourhood to ensure that various views and aspirations are captured. This echoes Pope et al. (2005) and Turcu (2012) that robust stakeholder engagement creates an avenue for social learning and more awareness on the concept of sustainability.

While this study appreciates that there are possibilities for several definitions of the sustainable neighbourhood concept which are driven by individual's diverse aspirations, a complexity in understanding introduces a challenge in how to define a sustainable neighbourhood, in a way that can be applied in planning and decision-making context. Does this require in general more prescriptive definition to be teased out at application in a way that is tailored to the context? Or should there be a less flexible and stringent definition to be complied with, by all who are planning and delivering urban neighbourhoods? If a collaborative approach is instead chosen to acknowledge the competing understandings whilst attempting to establish a workable understanding or definition, how will this affect the indicators used?

Such collaboration, where all relevant stakeholders are engaged to address the complexity of a sustainable neighbourhood and its indicators reflect procedural balance as argued in this study (section 4.5.1). An indicator set with this characteristic is beneficial in two ways. One, it encourages and enhances a sense of ownership to the whole process, and therefore greater likelihood of acceptance and use of its product. Two, an indicator set that enjoys such characteristics can be said to ensure that new neighbourhoods meet the need of the end-users. This further corroborates Ibem and Aduwo (2015b), and Olotuah and Aiyetan (2006) who canvassed for a participatory approach in planning for sustainability at the neighbourhood level. In fact, several neighbourhood developments have been abandoned by the intended users who found them unfit and unsuitable to meet their social, economic, or cultural aspirations.

However, whilst variations in stakeholders' understanding of a sustainable neighbourhood and its indicators exist, similarities also exist; which can be an agreed basis and platform for planning sustainable neighbourhood in metropolitan Lagos.

For example, both institutional stakeholders and residents shared similar perception about the indicators as follows: waste collection and management has priority over to renewable energy; security of lives and properties has priority over diverse mobility options; nearness to basic amenities compared to diverse mobility options; provision of neighbourhood square is more important than use of locally made material; availability of infrastructure and amenities compared to security; and good pedestrian lane compared to diverse mobility options.

5.2 Emerging Issues from the Characteristics of the Indicator Set

This section discusses the following emerging issues from the characteristics of the indicator set as shaped by the context of metropolitan Lagos and the implications in the visioning for a sustainable neighbourhood in that context. One, the tension between sustainability and liveability as reflected in the indicator set. Two, the comprehensiveness of the indicator set in terms of a holistic approach to addressing sustainability. Three, the peculiarity of the ranking and priority levels of the indicator when compared to other NSAFs. Four, the multidimensional character of the indicators in addressing more than one dimensions and aspects of sustainability. Five, the quantitative and qualitative nature of the indicators.

5.2.1 Liveability vs. Sustainability

An analysis of the indicator set identified in this study reflects a tension between the concepts of liveability and sustainability because some of the indicators tended to address liveability aspects rather than true sustainability aspects. Here, liveability refers to the enhancement of good living condition; while sustainability refers to a measure that captures and shows longevity towards perpetuity in the flow of resources. The distinction between liveability and sustainability indicators is crucial. For example, what may be liveability indicator to an urban individual e.g. availability of electricity may not necessarily reflect the sustainability of the urban neighbourhood. Mere availability or access to electricity enhances the quality of living, which relates to sustainable living; but does not reflect whether the source of the electricity is sustainable in the long-term. This tension was further substantiated in the stakeholders' understanding of a sustainable neighbourhood concept with "liveability and security" accounting for the second-largest percentage of entry in the analysis of the results. This perhaps is driven by the urgency to deliver neighbourhoods that contribute to a good living condition in metropolitan Lagos (Oduwaye, 2009; Ibem et al., 2015). So, to what extent does liveability and sustainability of material resources within an urban setting coincide? And more fundamentally, what is the role of NSAF indicators in interrogating and elaborating the resolution of this question?

Nevertheless, this finding of tension between liveability and true sustainability indicators appears to align with the indicator set of existing NSAFs which addresses the concern for liveability (BRE, 2012; GBCA, 2012; USGBC, 2016; and AUPC, 2010). For example, the BREEAM communities is driven with a vision of delivering neighbourhoods that are liveable (BRE, 2012); PCRS has a category in its indicator set called 'liveable communities' which is 22 per cent of its total weight. Additionally, it is noteworthy that scholars have in recent times argued that the campaign for sustainability needs to go beyond environmental sustainability, but should also include promotion of man's wellbeing, inclusion, and habitable urban spaces (Gehl, 2010, 2013; Lynch and Mosbah, 2017; Gough, 2015; Tapsuwana et al., 2018). Elaborating this further, the Science for Environment Policy (2015) posited that conceptualising sustainability at the neighbourhood level transcends addressing the question of whether man is living within environmental limits or not but entails the entirety of whether a good quality of life is enhanced.

Overall, liveability as a component which contributes to the living condition and wellbeing of residents in the neighbourhood has been a major character of sustainability (Wheeler, 2002). This position has been demonstrated by ODPM (2004); Turcu (2012); Green at al. (2005); and AtKisson, (1996) by capturing liveability as a critical characteristic of the indicators of a sustainable neighbourhood. Recently, it has been conceptualised to mean place-making at the neighbourhood level- an approach which advocates for creating healthy places for people (Parlemo and Ponzini, 2015; Arefi, 2014).

Therefore, if there is this ongoing consensus that liveability is a critical component for delivering sustainability, then, urban neighbourhoods can be helpful in this regard as the proper scale for assessing progress (Satterthwaite, 2002).

5.2.2 Integrational Balance

The integrational balance characteristic of the indicator set as demonstrated by the distribution of the weight of the sustainability dimensions (Environmental: 37.95 per cent; Economic: 31.1 per cent; and Socio-cultural: 31.0 per cent) is noteworthy. This aligns with the Bellagio STAMP which advocates for a balanced consideration of sustainability issues (Pinter et al., 2012). This implies that the indicator set by its weighing system takes the position of ‘strong sustainability’, that social capital and natural capital are not exchangeable by ensuring that environmental aspects are not compromised (Wangel et al., 2016).

For example, using the sustainability index in the decision-making process of a new neighbourhood can create three connected scenarios: One, satisfying the assessment criteria of all the environmental indicators will result to a score of 0.379 on a scale of 0 to 1 (that is, 37.9 per cent) which is relatively low. Two, consideration for only the assessment criteria in both environmental and economic dimensions would result in a score of 0.690 (that is, 69 per cent) which is not good. Three, to achieve a score of 0.80 (that is 80 per cent), it will require adequate consideration across the three dimensions in the sustainability index.

The uptake of the indicator set would also perhaps lead to the delivery of neighbourhood in metropolitan Lagos which encompasses sustainability aspects. That is, one which is environmental-friendly, socially responsive, and enhance economic prosperity which is currently lacking in metropolitan Lagos as evident in following categories: one are neighbourhoods that meet the requirement of affordability, but do not have adequate basic amenities and infrastructures to support good living if they are not located in an already serviced layout; two are neighbourhoods which attain a satisfactory level of environmental and social aspects but are not planned and designed to accommodate various income groups with some of them being a gated community (figure 5.1); three are neighbourhoods that are affordable but with a high cost of operation and maintenance; four are neighbourhoods that are affordable to low- or middle-income earners but with a challenge of waste management (figure 5.2) as a result of non-consideration for a waste collection and management plan for the neighbourhood at the decision-making process. Therefore, the integrational balance characteristic ensures that the indicator set does not only contribute to delivering sustainable neighbourhood but also ensures that existing neighbourhoods are not adversely affected as a result of the activities of new neighbourhoods.

Figure 5. 1: A gated neighbourhood in metropolitan Lagos
Source: Author, 2018

Figure 5. 2: An affordable estate in metropolitan Lagos with poor waste management
Source: Author, 2018

5.2.3 Role of Context

The high-ranking characteristic of some of the indicators is shaped by the context of metropolitan Lagos as further discussed.

The ‘cost of construction, operation, and maintenance’ with a weight of 12.4 per cent reflects its urgency in the light of metropolitan Lagos. Several amenities and infrastructures such as roads and drainages in some neighbourhoods have been left abandoned due to the huge cost that would be needed for their maintenance (figure 5.3). This condition most often results in environmental challenges such as flood and erosion for example when drainages become dilapidated. This supports Ijasan and Ogunro (2014); and Ibem et al. (2015) who advocated for affordable maintenance system for urban neighbourhoods. It calls for a neighbourhood that is affordable to maintain in terms of cost, technology, and manpower due to the increasing scarcity of resources. Similarly, this indicator was also given consideration in the Pearl Community Rating System (PCRS) which allocated 2.5 per cent of its total weighing to life cycle costing (IDP-1).

Figure 5. 3: An affordable estate in metropolitan Lagos with poor waste management
Source: Author, 2018

The ranking of ‘home affordability’ with a weight of 10 per cent provides support for Ugochukwu and Chioma (2015); and Olotuah and Aiyetan (2006) that emphasise affordability as crucial in delivering sustainable neighbourhood. This is because access to affordable homes has continued to remain a challenge in metropolitan Lagos (Mbali and Okoli, 2002; and Hamiduddin, 2015). This also provides support for Ocholi et al. (2015) and Raschke (2016) who advocated for the need to design appropriate platforms and incentives to facilitate homeownership for various income groups. For example, the Lagos State Government needs to intensify and ensure that the rent-to-own policy for low-income earners is sustained irrespective of change in government. In comparison with existing NSAFs which brings out the peculiar character of the indicator, home affordability does not seem to be a pressing challenge because BREEAM communities; PCRS; and Green STAR communities allocated 2.7 per cent; 1.28 per cent; and 4 per cent of their weighing system to home affordability respectively, except for LEED-ND V4 which allocated 7 per cent of its total weight to ‘housing types and affordability’.

Furthermore, the characteristic of ‘support for home-based business’ as a high-ranking indicator with a weight of 8.7 per cent reflects the urgency for its uptake in a megacity like metropolitan Lagos with a growing population. This finding appears to agree with Gibberd (2015), Ilesanmi (2010b), Ibem and Amole (2010) who emphasised the role of home-based business in ensuring sustainable economic growth at the neighbourhood scale. This would, for example, enhance the ability to work from home reducing the huge road traffic congestion characterised with air pollution at the city corridor while enhancing productivity. This also has the potential to create job opportunities for residents, while enhancing togetherness through local interaction.

Environmental Impact Assessment (EIA) which had a weight of 6.4 per cent is crucial for a growing urban population as that of metropolitan Lagos when new developments need to be assessed to ensure that they pose no threat to the environment and how certain mitigation measures can be taken. This importance has been stressed by several scholars have canvassed for a review of the EIA in Nigeria due to some identified shortcomings affecting the realisation of its full potential in metropolitan Lagos (Ogungba, 2004). In comparison with existing NSAFs, the EIA is compulsory for development to go through the BREEAM Communities assessment process. Besides, 3.2 per cent of its total weighing is allocated to transport assessment, and 1.8 per cent allocated to flood risk assessment (BRE, 2012). What is similar to the EIA was also noticed in the PCRS where the natural system assessment (NS-R1); natural system protection (NS-R2); and natural systems design and management strategy (NS-R3) are made mandatory for a proposed development (AUPC, 2010).

The high-ranking of ‘resource efficiency’ with attracts a weight of 6 per cent appears to be consistent with Ibem and Aduwo (2015b) who advocated for resource efficiency in planning public housing neighbourhoods in metropolitan Lagos. The uptake would ensure that the ability of future generations to meet their needs is not compromised thereby helping to achieve intergenerational equity. The ranking of the indicator seems to be in agreement with LEED-ND V4 used in the United States which also had a higher weighing for resource efficiency allocating 11 per cent (indoor water use reduction- 1 per cent; outdoor water use reduction- 2 per cent; building re-use-1 per cent; rainwater management- 4 per cent; infrastructure energy efficiency- 1 per cent; wastewater management- 1 per cent). This further aligns with the Pearl Community Rating System (PCRS) used in Abu Dhabi that considers resource efficiency, especially on water and energy allocating about 50 per cent of its total weighing to this (AUPC, 2010). This perhaps is as a result of its geographical location where water is a scarce commodity. However, the indicator has a lower weight of 2.7 per cent in BREEAM Communities.

Pollution control which attracts a weight of 5.1 per cent reflects the picture in metropolitan Lagos where noise, air, and water pollution has been a major source of concern in its neighbourhoods (Komolafe et al., 2014). This agrees with the BREEAM communities which for instance allocated 3.8 per cent of its total weighing to indicators addressing pollution (SE 04 noise pollution-1.8 per cent; SE 16 light pollution- 0.9 per cent; and SE 03 water pollution-1.1 per cent). PCRS has no indicator for pollution control while LEED-ND V4 and Green star communities allocated 0.9 per cent and 1 per cent only for light pollution reduction respectively.

The ranking of 'waste collection and management' with a weight of 4.9 per cent reflects its urgency to enhance sustainability at the neighbourhood level and at a larger scale in a growing urban population like that of metropolitan Lagos where waste management has been a challenge (Figure 5.4). In recent times, there has been a decline in environmental quality in metropolitan Lagos due to inadequate waste collection and management strategy (Ozabor and Heneietta, 2016). The uptake of this indicator would, therefore, serve as a preventive measure to outbreak of diseases associated with poor waste management (Oghenekohwo and Akporehwe, 2016) whilst also preventing the emission of greenhouse gasses and subsequently ozone layer depletion, and pollution associated with indiscriminate refuse dumping (Komolafe et al., 2014). In addition, the recycling of household wastes perhaps may reduce the high demand for raw materials in the urban space at large (Jiboye, 2010). In relation to other contexts, Green Star communities used in Australia allocated 2 per cent to encourage projects that reduce the environmental impacts of waste (GBCA, 2012). Waste management in BREEAM Communities, was discussed under resource efficiency (RE 06) allocating 2.7 per cent of total weighing. Pearl Community Rating System made provisions for construction (SM-5), operational (SM-6), organic (SM-7), and hazardous wastes (SM-8) accounting for 4.4 per cent of its total weighing (PCRS, 2010). LEED-ND has two credits for waste management which are: recycled and reused infrastructure and solid waste management both accounting for 1.81 per cent (USBGC, 2016).

Figure 5. 4: Waste collection situation in a neighbourhood in metropolitan Lagos
Source: Author, 2018

Lastly is ‘strategy to maintain infrastructure’ which attracted a weight of 4.4 per cent. This has not been given much consideration in term of the policy and regulatory frameworks in metropolitan Lagos and other Sub Sahara Africa cities. This is important because it involves a facility management plan to enhance the continuous functioning of infrastructure and amenities (Ilesanmi, 2010a; 2010b). This indicator received a higher ranking when compared to existing NSAFs. For example, it was discussed under ‘environmental management’ in Green Star Communities with a weight of 2 per cent. In BREEAM Communities, strategy to maintain infrastructure was noted under community engagement of facilities (GO 04) with a weight of 1.2 per cent of its total weight (BRE, 2012). However, there was no consideration for infrastructure maintenance in LEED-ND and PCRS.

The high-ranking characteristics of the indicators as influenced by the context of metropolitan Lagos, and in comparison with existing NSAFs further establishes the peculiarity of the indicators that could enhance the delivery of sustainable neighbourhood in metropolitan Lagos. For example, the following preferences were specific to findings from metropolitan Lagos: waste collection and management has priority over renewable energy; security of lives and properties has priority over diverse mobility options, and nearness to basic amenities has priority over diverse mobility options. However, findings from this study show some similarities with some NSAFs in terms of preference when the indicators are compared to one another which is noteworthy. In alignment with BREEAM Communities: waste collection and management has priority over strategy to maintain infrastructure; strategy to control pollution has priority over waste management; environmental impact assessment has priority over efficient use of resources, and effective land usage; social amenities and infrastructure have priority over security of lives and properties. The indicator set agrees with Pearl Community Rating System (PCRS) that: cost of construction, operation, and maintenance has priority over home affordability; social amenities and infrastructure have priority over security of lives and properties. It supports Green Star Communities that: home affordability has priority over support for home-based business; nearness to basic amenities has priority over diverse mobility options; social amenities and infrastructure have priority over security of lives and properties. Lastly, it agrees with LEED-ND that: use of renewable energy has priority over greenfield preservation, and social amenities and infrastructure have priority over security of lives and properties.

This discussion on the role of context in shaping the characteristics (e.g. ranking) of the validated indicator suggests that their uptake can help address the current sustainability challenges at the neighbourhood level in metropolitan Lagos ensuring that new neighbourhoods are not in themselves unsustainable but instead contribute to the overall sustainability of metropolitan Lagos. The uptake of the indicators in another context outside metropolitan Lagos without establishing their characteristics in terms of their ranking may result in prioritising the wrong indicators.

5.2.4 Interrelationship and Interdependence

The aspect characteristics of the indicator set suggests the interrelationship in addressing the various sustainability aspects and dimensions. For example, there is no single indicator that addresses economic issues without the link to either environmental or socio-cultural concerns. 17 out of the 23 indicators representing 73.19 per cent address more than one dimension of sustainability. For example, the cost of construction, operation, and maintenance which has the highest weight would not only contribute to economic aspects but also socio-cultural. The indicators are inherently not a single issue or single dimension in nature. The interrelationship characteristic of the indicator set has some similarities with existing NSAFs as presented in table 5.1 using Dawodu et al. (2017). Environmentally and socially (Env-Sc) focused indicators have the highest distribution of indicators across the frameworks. However, the percentage distribution of the indicators with planar characteristics (that is, addressing the three dimensions) is higher in the proposed indicator set when compared to BREEAM Communities (10%) and CASBEE (2%). This suggests that the interrelationship of the indicator set can help to enhance and promote the overall sustainability of new neighbourhoods in metropolitan Lagos.

Table 5. 1: Comparison of the distribution of indicators in BREEAM Communities and CASBEE

Indicators	Env	Sc	Ec	Env-Ec	Env- Sc	Sc-Ec	Ec-En-Sc
Proposed Indicator set	8.69%	17.39%	0	8.69%	30.43%	13.05%	21.75%
BREEAM	20%	13%	0	0	29%	25%	10%
CASBEE	26%	9%	6%	6%	26%	13%	2%

Source: Author, 2020

5.2.5 Measurability

The indicator set also exhibited quantitative and qualitative nature in their characteristics. The high proportion of indicators that are qualitative in nature is perhaps as a result of the fact that the indicator set is to be helpful at the planning and designing phase of a new neighbourhood prior to implementation in what is known as ‘ex-ante’ which is the focus of this study. This is unlike the ex-post indicators which are most times quantitative in nature that attempt to measure in quantitative terms the actual performance of the neighbourhood after some years of occupancy.

It is however noteworthy that combining both quantitative and qualitative measures has an advantage. While the qualitative measurement can be subjective because they are based on individual judgments from users' perception, the quantitative gives an objective measurement as they are sensed by instruments outside the users, such as thermometers or counters that is verifiable by others (Waas et al., 2014). In addition, the final product and solution could be without the required quality if decisions are guided only by quantitative indicators.

5.3 Role of Critical Realism in the Study

Critical realism adopted for this study was useful in interpreting and obtaining a deeper understanding of the findings. It helps to suggest reasons for the findings, examining it from the perspective of the present reality in metropolitan Lagos. The characteristics of the indicator set of a NSAF that emerge in this study can be explained on the following basis.

One, the contextual balance characteristics of the indicator set can be said to be influenced by the growing call for neighbourhoods that promote liveability in metropolitan Lagos as espoused by Ibem et al. (2015). This was also evident in the stakeholders' understanding of a sustainable neighbourhood as responses focused majorly on enhancing the quality of living.

Two, whilst the socio-cultural dimension under which there is liveability accounts for 12 of the 23 indicators, the result from the stakeholders' preferences through which the indicators were weighted and ranked ensures an intergenerational balance of the indicator set. This was evident in the distribution of the weight across the three main dimensions of sustainability adopted for the study (environmental: 37.95 per cent; economic: 31.1 per cent; and socio-cultural: 31.0 per cent). From the critical realism lens, this may be attributed to the existing reality in metropolitan Lagos, that while some neighbourhoods are affordable that promotes local economy; there exist huge environmental challenges in terms of waste management, pollution control, and greenfield preservation amongst others. In addition to this, the aspect characteristics of the indicator set where at least 17 out of the 23 indicators can be explained under more than one dimension of a sustainable neighbourhood can also be explained in this light.

Three, explaining from the critical realism philosophical position, the high concentration of pressure indicators from the DPSIR framework points to the growing population of Lagos State which has led to the increased demand and consumption of available resources- a scenario which may perhaps be different in a city of lesser population. This is because, the more the population, the higher the consumption rate of resources reason for the campaign to ensure sustained urban population growth. For example, there is a demand for energy, land, security, participatory planning and design to diverse population mix, and green fields amongst others.

Four, the characteristics of the indicators as either process, features, or performance indicators is a reflection that in metropolitan Lagos, there is need to focus beyond provision of some components (e.g. infrastructure which is a feature indicator) to the establishment of some process indicators like strategy to maintain infrastructure to ensure longevity of the infrastructure. The consideration of other process indicators (such as waste collection and management, impact assessment) is also helpful, as they will not only lay a good foundation for the sustainability of the proposed neighbourhood but could also serve as an avenue for awareness and social learning amongst the diverse groups of stakeholders.

Five, the high-ranking indicators further ground the influence of the existing reality of metropolitan Lagos on the stakeholders' perceptions and preferences of a sustainable neighbourhood and its indicators. It helped to establish that professional affiliations, and the respective roles played in neighbourhood development do not influence their understanding of the sustainable neighbourhood concept. Rather, what perhaps are the driving influences are the individuals' needs, values, and aspirations which are shaped by the reality of the context. For example, the current state of metropolitan suggests that planning for a sustainable neighbourhood should not only be concerned with the initial cost but also the projected cost of its operation and maintenance. Other high-ranking indicators like home affordability, efficient use of resources, pollution control, and waste collection and management could be helpful to address the critical sustainability challenges that presently confront neighbourhood in metropolitan Lagos.

5.4 Contributions of Study

The contributions of the study can be discussed under the following headings:

5.4.1 Theoretical Contributions

Theoretically, the study adds to the literature on the indicator set of a NSAF in the following ways. One, it grounds the idea of the complexity of sustainability as a concept, because diverse definitions emerged from stakeholders' understanding of a sustainable neighbourhood. This opens the discussion for a consensus definition for a sustainable neighbourhood in metropolitan Lagos, which is necessary to ensure that planning solutions adopted elsewhere are not directly implemented in Lagos. Rather, the solutions which appreciate and recognise the context based on people's needs, values, and aspirations are developed. Two, this study questions the idea of context-specificity of indicators by arguing that indicators can be universal, with however the distinguishing factor being their characteristics as explored in this study. This lays the foundation to compare the characteristics of indicators in another context.

Three, by developing the indicator set of a NSAF for decision-making and their priorities in metropolitan Lagos, the study addresses Yigitcanlar (2013) and Berardi (2013) who advocated for a system of criteria for assessing neighbourhoods in developing countries most especially in Sub-Sahara Africa (SSA). Four, the study has also shown the extent to which a context where a NSAF has not yet been conceived or developed, can rely on indicator set of existing NSAFs for use in the decision-making process of a new neighbourhood. Five, this study teases out the theoretical challenge of how to callibrate between liveability and true sustainability indicators especially as regards resources flow. It questions how this balance can be achieved if it all is possible. This further questions the extent at which sustainability can be delivered at the neighbourhood scale taking into consideration the dominance of liveability criteria. Six, in the methodological body of knowledge, this study provides a successful example of using the embedded and the convergent mixed-method to explore the characteristics of the indicators of a NSAF for neighbourhood development in metropolitan Lagos. This could, therefore, serve guidance to conduct a study of a similar nature.

5.4.2 Practical Contributions

There are three main practical contributions of the study. One, the integration of the indicator set into the substantive aspect for decision-making, can be helpful to operationalise and achieve the ‘SDG 11 targets’ (aimed at the delivery of sustainable communities) at the neighbourhood scale in metropolitan Lagos. This is because the indicators are fairly distributed across the 10 targets (figure 5.5). What this implies, is that the effect of the uptake of the indicator set can position metropolitan Lagos as a reference megacity for other growing urban areas in SSA and beyond. For example, progress towards the first target which is adequate, safe, and affordable housing can be assessed by five of the indicators which are: home affordability; security; the cost of construction, operation and maintenance, quality of construction material; and support for a home-based business.

Two, the indicator set could be useful for decision-making in planning new neighbourhoods in metropolitan Lagos before it is built. This is because a proposed development can now be benchmarked against sustainability targets empirically derived from stakeholders’ understanding of the concept. For example, assessing the proposal against the indicator set can give a picture of the sustainability credential of the development on a scale of 0 to

1. With this, decision-makers could know whether to proceed with a proposed development or not based on this credential. This is in addition to the fact that practitioners and decision-makers can now also prioritise sustainability indicators in decision-making based on an evidence-based framework. Three, the identified indicators can inform urban policies tailored towards achieving sustainability goals and visions, while also providing a platform to assess current interventions for sustainable neighbourhood planning and design in metropolitan Lagos. Stakeholders can now determine which indicators should be prioritised in their policies based. It also provides an empirical basis to integrate sustainability aspects such as 'strategy to maintain infrastructure' which has not been given much consideration in policy formualtion.

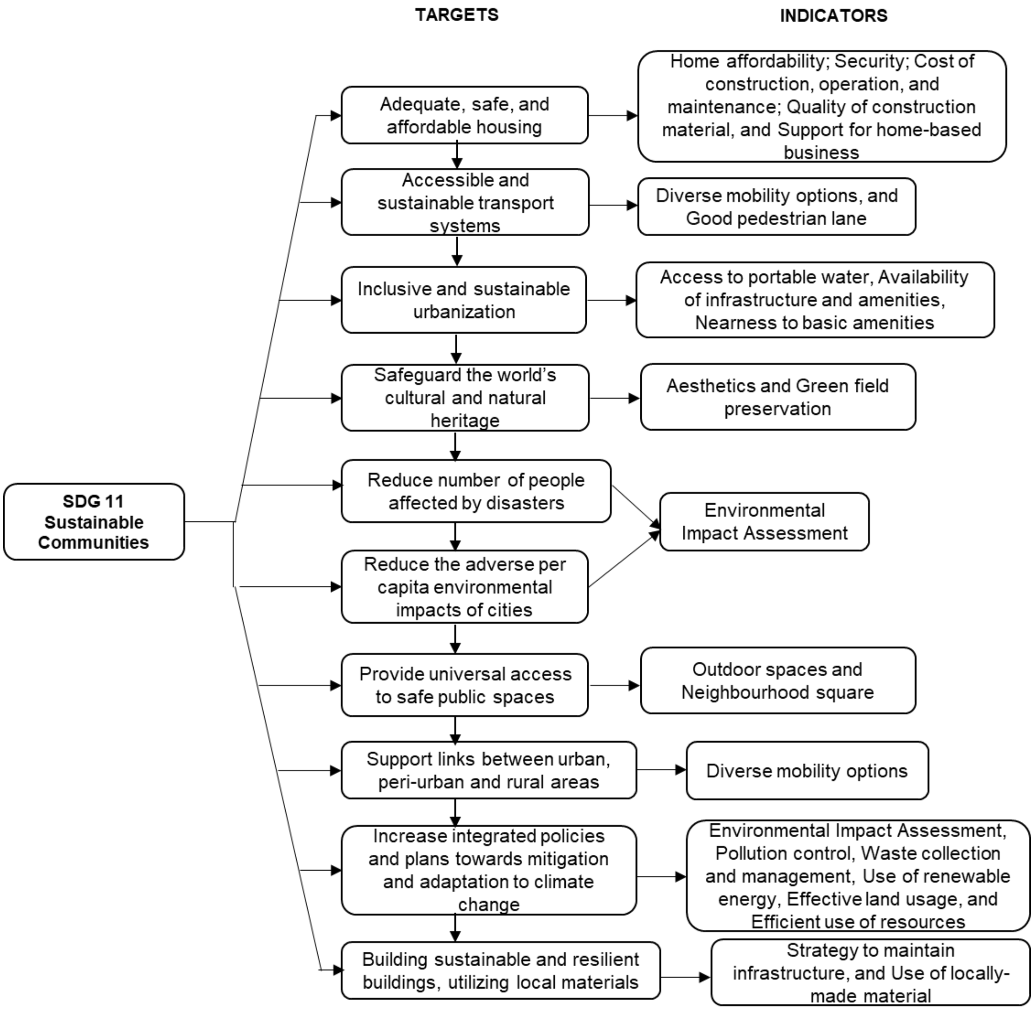

Figure 5. 5: Potential of the indicator set to deliver the targets of SDG11
Source: Author, 2020

5.5 Study Limitations and Scope for Future Research

The following limitations were identified in this study which was helpful to identify potential areas for future study. One, stakeholders' preferences of the indicators established through the Analytical Hierarchy Process (AHP) was perceived to be time-consuming and complex for the respondents. Consequently, some sections of the AHP questionnaire were not completed by few respondents thereby invalidating their questionnaire. This challenge was addressed by analysing only questionnaires that were fully completed. In future research, while the AHP seems to be robust, other methodologies to elicit weight can be adopted such as the Analytical Network Process (ANP). Two, as this study also engaged institutional stakeholders, the study was limited to the sample size of 309 residents from three selected neighbourhoods. Although findings showed similarity in the perception of both categories of stakeholders (that is, institutional and residents), with increased sample size, future research can focus on residents who are the consumers of neighbourhood development.

Other areas for future research are: One, because this study focused on how the context of metropolitan Lagos shaped the characteristics of the indicator set of a NSAF for neighbourhood development, it would be worthwhile to explore the characteristics of the indicator set in other emerging cities in Nigeria and other Sub-Sahara Africa countries, to establish any similarities or differences using a comparative analysis. Two, because this study focused on ex-ante indicators which are integrated in the decision-making process of a proposed neighbourhood in its planning and design stages prior to construction, further research can explore the ex-post indicators which will be useful to evaluate a neighbourhood after some years of operation and occupancy. This is on the basis that sustainability is a process and as a result, regular monitoring is important to ensure that the neighbourhood continues to exist and function under the ambit of the sustainability agenda proposed or envisaged at its planning and design phases.

5.6 Summary

This chapter discussed the findings from this study in relation to the research question. There exists a complexity in the stakeholders' understanding of a sustainable neighbourhood with their various perceptions of the concept influenced by the reality of metropolitan Lagos- an understanding established by the critical realism philosophical stance adopted for this study. As a result, the themes that emerged from stakeholders' understanding present an argument as to whether sustainability at the neighbourhood level in metropolitan Lagos is conceived in liveability terms and much less in true sustainability terms.

This chapter discussed other emerging issues from the characteristics of the indicator set as shaped and influenced by metropolitan Lagos which are related to the integrational balance and interrelationship of the indicator set, the ranking of the indicator set, and its measurability. For example, the context-specificity of sustainability was further justified when the weighing and ranking of the indicators when compared to that of existing assessment frameworks of BREEAM Communities; LEED-ND; Green STAR Communities and PCRS. For example, waste collection and management had a higher preference for renewable energy in metropolitan Lagos unlike in some NSAFs where renewable energy had a higher preference. However, some similarities could be observed for some indicators.

The significances of this study in terms of theoretical and practical contributions which concludes the chapter were highlighted. In addition to enriching the existing body of knowledge of sustainability and the application of its indicators at the neighbourhood level in a developing country context, the indicator set as discussed could serve as a mechanism to achieve the targets of SDG 11 in metropolitan Lagos as a key practical contribution.

CHAPTER 6 CONCLUSION AND RECOMMENDATIONS

This chapter presents the conclusion and recommendations of this study. It gives a brief overview of the study, and revisits the research question to know how it has been answered based on key inferences from the research objectives. This chapter completes the study with some recommendations based on findings.

6.1 Overview of Study

The increasing global urban population has been associated with key sustainability challenges that threaten both the nature of the environment and the continued existence of man. As a result, it has been widely acknowledged that the battle for sustainability will be won or lost in cities as most people in the world will be living in urban areas. However, to deliver future sustainable urban areas, there is an idea that approaches at the neighbourhood scale of spatial planning can play a key role, and significantly assure sustainability in urban areas. The argument that has gathered traction states that neighbourhoods can form the building blocks of cities, and incrementally and cumulatively, in turn, be helpful to achieve sustainable urban areas at large. The challenge is that neighbourhoods are themselves subject to and are products of a decision-making process. It is in this context, that NSAFs with indicator set as key ingredients for deliberate decision-making that integrates sustainability considerations, have been developed in various context as a mechanism to assess a proposed neighbourhood against an array of sustainability indicator sets.

The problem has been that to date, NSAFs have been developed and are formally applied in the western developed nations, with little examples of NSAFs developed specifically for SSA context. The implication is that the growing urban population of metropolitan Lagos, in the absence of a NSAF to support decision-making towards sustainability, may grow and continue to develop in unsustainable ways. As the non-transferability of NSAFs has been established due to the differences in culture, aspirations, values, preferences and priorities, legislations and technical know-how, it becomes more urgent that Lagos develops its own NSAF.

This study was therefore formulated and conducted to explore the characteristics of indicators of a NSAF that can be used in the decision-making process in the development of neighbourhoods in metropolitan Lagos, Nigeria. Because direct methods to accurately identify and decide on the importance assigned to each indicator is difficult to find, there was merit in resorting to the experience and perspectives of relevant stakeholders to gather useful data. This was achieved by designing and implementing a research project that relied heavily on stakeholders as a source of data and as a reference point for analysis. Data was gathered from them, based on their local perspectives, after which the stakeholders were considered a focus of analysis as interpretation of importance, and significance was based on the frequencies of the themes they indicated. To have a robust understanding of the significance attached to the indicators identified by the stakeholders, statistical analyses were also undertaken.

Overall, the results of this study have provided an understanding of sustainable neighbourhoods; established a set of desirable and appropriate indicators; and explored how the indicators can be described in terms of their key characteristics that have a bearing on their significance in terms of the nature of contribution to what a sustainable neighbourhood is. It is envisaged that findings from this study could perhaps serve as a guideline for other emerging cities in Nigeria and other SSA countries encountering similar challenges of urban sustainability.

6.2 Key Messages and Conclusions from the Study

This study was guided by key objectives as building blocks laying the foundation to address the research question from which the following conclusions were drawn.

6.2.1 Universality of Indicators vs. Context-specific Indicators with Characteristics as the Distinguishing Factor

While this study envisaged there might be context-specific indicators for an urban context like metropolitan Lagos, the preliminary findings from objective 1 of "*identifying generic sustainability indicators at the neighbourhood level from literature"* raised the conclusion that there are indicators which appear to be universally accepted and carries weight and significance around similar issues and in similar ways. Also, there are those other indicators which are not universal, and therefore represent more localised elements related to, defined by, and attributed to contingencies of the context. This position was further supported by findings from objective 2 which involves "*exploring stakeholders' understanding of the concept of a sustainable neighbourhood in metropolitan Lagos".* Although there were noticeable variations, many perceptions of the stakeholders align with existing definitions of the concept which is centred on enhancing environmental integrity and meeting the needs of both present and future generations.

This is interesting in two ways. Either, one, it underpins the notion of universality, perhaps traceable to the fact that most urban areas are exposed to similar challenges of pollution, environmental degradation, climate change, a decline in living standard due to the pressure on the limited infrastructure and amenities, and loss of biodiversity among others. Or, it underpins the notion that policy ideas can have significant currency; so that the Brundtland Commission definition of sustainability becomes an overarching unchallenged and accepted understanding, informing other sectors such as urban planning member states. As a result, top at the agenda of all urban areas is the focus on man's needs and ensuring that developments are within the earth's carrying capacity. It is not clear to what extent this definition carries any empirically defensible value at the neighbourhood level to which most stakeholders claimed it to.

This notion of the universality of indicators has provided a conceptual understanding and justification of the adoption of some existing NSAFs for decision-making by some countries, especially in SSA. For example, the Green Building Council South Africa (GBCSA) and Ghana Green Building Council (GHGBC) announced the launch of the locally applicable version of the Green Star Certifications originally developed in Australia for use in South Africa and Ghana respectively with the aim of delivering sustainable settlements. However, the success of this is an area yet to be explored, as to whether the weight and ranking assigned to the indicators agree with the preferences and priorities of the stakeholders of the context where they are being applied

However, whilst the universality of indicators has been identified as one of the inferences from the study objectives, their characteristics in various contexts seem to be the distinguishing factor. This has been demonstrated in this study by how the context of metropolitan Lagos influences the characteristics of the selected indicator set. For example, there seem to be differences in terms of weighting and ranking of indicators when compared to a similar one in an existing NSAF. This study has therefore provided a new understanding that although the indicator set may be universal and be applicable to all cities, their characteristics remain the distinguishing factor.

6.2.2 Liveability as Essential for Neighbourhood Sustainability

It can further be inferred from research objective 2 that liveability is essential in planning for neighbourhood sustainability as prominently reflected in the stakeholders' understanding of the concept. This leads to a question of the balance and to what extent does liveability map onto sustainability from a resource perspective? The study, therefore, concludes that visioning sustainability and its indicators at the neighbourhood level transcends addressing such challenges like climate change, biodiversity loss, pollution, and land and water degradation which could help to deliver environmental sustainability, but entails amongst other aspects like liveability, security, provision of amenities and infrastructure, and economic prosperity as canvassed by the United Nations Sustainable Development Goal (SDG) 11 targeted at delivering sustainable communities. Yet there is a need to find a balance as to how the proportion and weight of the indicators should be distributed between liveability and sustainability. For example, every urban neighbourhood irrespective of the geographical location, policies and frameworks wants an efficient waste management system; adequate amenities and infrastructure, inclusive approach to planning, and support for local economy among others.

6.2.3 Similarity in Stakeholders' Perceptions

Whilst engagement with stakeholders has been argued to be crucial in sustainability agenda, this study concludes based on its findings from objective 3 which involves "*establishing the indicators of a decision-making framework for metropolitan Lagos as influenced by the context-specific perceptions and preferences of stakeholders*", that the perceptions of institutional stakeholders' and residents of a sustainable neighbourhood and its indicators are the same. This was statically established with the ANNOVA test that "*both institutional stakeholders and residents have the same perception on sustainability dimensions and indicators".* For example, while the questionnaires were administered separately, both categories of stakeholders had a similar perception of 24 out of the 25 indicators (22 as important; 2 as not important). However, this is not to compromise the role of any of the stakeholders in planning for urban sustainability. This is because, such a process creates room for social learning, while also enhancing a sense of belonging which is essential for the success of any proposed development.

6.2.4 Potentiality of the Indicator Set to Deliver Sustainable Neighbourhoods

In addition to the internal validity of this study which was strengthened by research objective 4 which involves "*validating the developed indicators by testing their potential usability and adoptability, whilst identifying the likely barriers of their uptake for decision-making*", it also established the benefits and key potentials that the uptake of the indicator set could bring to metropolitan Lagos.. The stakeholders were definite in their responses that by addressing some key barriers, the vision for functional and sustainable Lagos would be achieved, especially if the indicators are integrated into the decision-making process of new neighbourhoods. This is because the indicator set represents what the stakeholders consider as signifying their vision and concept of a sustainable neighbourhood. It could, therefore, be inferred from the validation that the potentiality in the selected indicator set is significant.

6.3 Research Question Revisited

The study sought to address the question of the "*characteristics of indicators of a NSAF that could guide decision-makers in considering and delivering sustainable neighbourhoods in metropolitan Lagos, Nigeria*". It attempted to know how the context of Lagos, Nigeria affects the nature of the indicators that can be used in the decision-making process of a new neighbourhood.

The following characteristics have emerged about the selected set of indicators in this study, using the four main approaches for characterising the indicator set. One is the multidimensional nature of the indicators in addressing more than one aspect of sustainability as demonstrated by their aspects characteristics. Two is the dominance of pressure indicators which is typical of a growing urban population like metropolitan Lagos where there is a high demand for limited resources and infrastructure. Three, as shaped by stakeholders' preferences, the top 4 high-ranking indicators are cost of construction, operation, and maintenance; home affordability; support for home-based business; and Environmental Impact Assessment; whilst the least 4 low-ranking indicators are inclusive design; use of public arts and landscape elements; good pedestrian lane; and neighbourhood Squares.

Four is a fair distribution across sustainability aspects ensuring the delivery of neighbourhoods that socially responsive, environment-friendly, and economically viable. Five, although there are noticeable and distinguishable characteristics that are context-driven, there exist some similarities with existing NSAFs in terms of weight assigned to some of the indicators. Six is the potentiality of the indicator set to deliver neighbourhoods that are liveable which would increase the quality of living in metropolitan Lagos. Seven is the potentiality of the indicator set to deliver neighbourhoods with a focus beyond performance, but also on key processes that could facilitate and encourage stakeholders' engagement in the design process. Eight is the potentiality to ensure that existing neighbourhoods are not in any manner affected by a new development by their relational characteristics.

6.4 Overall Conclusion

Having explored the characteristics of an empirically selected indicator set for a NSAF, this study concludes by supporting the argument that the indicator set of a NSAF cannot be transferred directly for use in another context without some empirical basis prior to its integration into the decision-making process of new neighbourhood development. For example, there is a need to ensure that the ranking of the indicators which indicates the expected priority in the decision-window, aligns with the preferences of the local stakeholders where it is being adopted. There is a need for caution as to the extent to which the indicators can be balanced between what is essentially a reference to liveability, rather than sustainability from the perspective of resources flow.

This study, therefore, appreciates the role of context in sustainability assessment. This is because a high-ranking indicator in a context may be a mid-ranking indicator in another context. In addition to this, the characteristics of an indicator as a 'response indicator' depends on the interventions that can be made available in a context which are influenced by technological know-how, political will, and sustainability awareness amongst others.

6.5 Recommendations

This study has demonstrated that whilst sustainability indicators can be universal, their characteristics are what distinguish them from one context to another. On this basis, this study recommends the following ways to capitalise on the insights from the study: One, a robust consultation which would capture the values, aspirations, and needs of all relevant stakeholders in exploring the characteristics of the indicators of a NSAF. This would also help to create awareness crucial to drive the urgency and implication of sustainability to stakeholders involved in decision-making at the neighbourhood level, whilst also addressing the complexities in stakeholders' understanding of a sustainable neighbourhood. This can be operationalised through various talk-shops where people are enlightened about their expected roles and contributions to make their neighbourhood sustainable. Such awareness could result in behavioural changes that deliver efficient use of resources, greenfield preservation, and waste management amongst others. In addition, a consensus definition of a sustainable neighbourhood in metropolitan Lagos could emerge from that process.

Two, as it emerged from this study that cost of construction, operation, and maintenance is a high-ranking indicator, this study recommends that it is important to manage the cost of a project, without compromising the sustainability levels and quality of the proposed development. In addition, the government should on its part encourage private developers interested in delivering affordable homes. This could be by providing the necessary infrastructures and amenities for the proposed neighbourhood. In this light also, the government can help developers to have more resources to address other aspects that can contribute to the sustainability of the neighbourhood by reducing the high administrative charges (e.g. approval) of a new neighbourhood. In addition, it is also high time for the implementation of the collaboration and partnership with financial sector operators and regulators as stipulated in the National Housing Policy (NHP). This is to facilitate linkages to the capital market to provide long term affordable and sustainable liquidity for neighbourhood development.

Three, the need for the timely uptake of the indicators in metropolitan Lagos which emerged from the validation phase, suggests the importance of the political will to integrate the indicators at the planning, design, and approval phases of a new neighbourhood. Four, as the indicators display both quantitative and qualitative characteristics in terms of their assessment in a proposed development, the role of data becomes important. To this end, the size of metropolitan Lagos requires a conscious effort to establish a data management institution saddled with the statutory responsibility of obtaining and updating the database of metropolitan Lagos, which would be useful at the various decision-windows of new development. The government in this instance can help by providing the required funding for the data collection, statistical production, analysis, monitoring, and evaluation. In addition, a cyber planning portal can be created whereby data can easily be accessed by all stakeholders.

Five, because some of the indicators are best described as ‘features indicators’ such as renewable energy systems and use of locally-made material which requires some technological know-how as expertise, this requires the training of professionals in the built environment to ensure that they are fully knowledgeable and equipped on the recent and thriving innovations in sustainability discourse. One of the ways to actualise this is by the development of innovations labs and knowledge transfer hubs in strategic locations. This might also involve the development of institutions and programmes for both skilled and unskilled labour, including attachments to competent institutions in foreign countries creating well-defined exposure and practical training. It is important to stress that this goes beyond “imported technology” as trainees also need to explore local technologies which are affordable and sustainable in themselves. As a result, the Nigeria Building and Road Research Institute (NBRI) needs to intensify efforts in integrating applied research and development (R & D) in the building and construction sector which has the potential to lead to tremendous improvements towards indigenous technology on local building construction.

Six, the delivery of demonstration projects is also essential which would further help in conceptualising what a sustainable neighbourhood would look like in the context of metropolitan Lagos, and can be repeated in other locations of the city. This can be achieved through sustainable practice exhibition involving the identification, documentation, and dissemination of best practices aimed at enhancing sustainability in metropolitan Lagos. More so, lessons can be drawn from these demonstration projects on how built-environment professionals can make improvements in better delivery of sustainable neighbourhoods.

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APPENDICES

Appendix 3.1- Ethical Approval Letter

University of Dundee

Schools of Social Sciences and Humanities

School Research Ethics Committee

Solomon Adewumi
41 Milnbank Road
Dundee
DD1 5QA

23rd August 2017

Dear Solomon,

Application No: SRECPhD-010

Your application has been reviewed by the School Research Ethics Committee, and there are no ethical concerns with the proposed research. I am pleased to confirm that the above application has now been approved.

Yours sincerely

L.Mcfarlane

Linn McFarlane
PhD Administrator

cc: Dr Vincent Onyango

UNIVERSITY OF DUNDEE
Dundee DD1 4HN Scotland UK
e srec-socialsciencesandhumanities@dundee.ac.uk w
www.dundee.ac.uk/main/research/ethics/ The University
of Dundee is a registered Scottish charity, No: SC015096

Appendix 3.2- Request for Nomination of Participant

ARCHITECTURE AND URBAN PLANNING
SCHOOL OF SOCIAL SCIENCES
UNIVERSITY OF DUNDEE

28th August 2017

The General Manager
Lagos State New Towns Development Authority (NTDA)
Lagos State Government Secretariat, Ikeja
Lagos, Nigeria

Dear Sir,

REQUEST TO NOMINATE A STAFF TO PARTICIPATE IN A SURVEY

My name is Ayomikun Solomon Adewumi- a doctoral researcher in the University of Dundee, UK. I am working on a research project titled “**An Exploration of the Characteristics of the Indicators of a Sustainability Assessment Framework for Neighbourhood Developments in Metropolitan Lagos Nigeria”**. The purpose of this research is to investigate stakeholders’ perception of a sustainable neighbourhood in metropolitan Lagos and preferences in selecting its factors.

The survey intends to engage your institution due to its crucial role in regulating neighbourhood developments in Lagos. Therefore, I want to humbly request for a staff member to be nominated for this purpose. I will be coming to Nigeria for this field work where the identified staff will be administered a self-completed questionnaire. I intend to visit to Nigeria in the middle of September.

Thank you Sir in anticipation of your kind response.

Yours Faithfully,

Ayomikun Solomon Adewumi
PhD Candidate
Architecture and Urban Planning
School of Social Sciences
University of Dundee, DD1 4HN
Email: s.a.adewumi@dundee.ac.uk

Appendix 3.3- Participant Information Sheet

ARCHITECTURE AND URBAN PLANNING
SCHOOL OF SOCIAL SCIENCES
UNIVERSITY OF DUNDEE

PARTICIPANT INFORMATION SHEET

An Exploration of the Characteristics of the Indicators of a Sustainability Assessment Framework for Neighbourhood Developments in Metropolitan Lagos Nigeria

Invitation to take Part an A Research Study
My name is Adewumi Ayomikun Solomon, a doctoral research student in the University of Dundee in the school of Architecture and urban planning. I will greatly appreciate your assistance by way of completing this survey questionnaire. The purpose of this research is to investigate stakeholders' perception of a sustainable neighbourhood in metropolitan Lagos and preferences in selecting its factors.

What to Expect
This survey asks about your understanding of what a neighbourhood that is considered sustainable should look like. The survey present a list of indicators (factors) which you will be expected to indicate the level of importance of these indicators. Most importantly, you are encouraged to suggest any other sustainability factors that you think are important.

Time Commitment
It is a short survey which can be completed within approximately 15 minutes. I may need to come back to you for clarity.

Cost, Reimbursement and Compensation
Participation for this research is voluntary and as a result there will be no reimbursement or compensation.

Risks and Termination of Participation
There are no known risk for your participation in this study as your identity will be kept confidential. Data gathered in this survey will be anonymised. As a voluntary participant, you may decide to stop being a part of the research study at any time without explanation and without penalty.

Confidentiality/Anonymity
I want to assure you that all your input in this questionnaire will be used for academic purpose only and your confidentiality will be guaranteed. The researcher has the primary control and access to data obtained in this survey. Only the results from the survey in anonymised form will be reported or published.

For Further Information about this Research Study
I will be happy to answer any question about the study. Below is my contact information

Adewumi Ayomikun Solomon (PhD Candidate)
School of Social Sciences; University of Dundee, DD1 4HN
Scotland, UK; Email: s.a.adewumi@dundee.ac.uk

The University Research Ethics Committee of the University of Dundee has reviewed and approved this research study.

Appendix 3.4- Participant Consent Form

UNIVERSITY OF DUNDEE

ARCHITECTURE AND URBAN PLANNING
SCHOOL OF SOCIAL SCIENCES
UNIVERSITY OF DUNDEE

PARTICIPANT CONSENT FORM

An Exploration of the Characteristics of the Indicators of a Sustainability Assessment Framework for Neighbourhood Developments in Metropolitan Lagos Nigeria

I have read Information sheet for participants for this study which has given enough clarity on the scope of the study. I understand that I may ask further questions at any time. I have also been informed that I am free to withdraw my participation at any time and I am not obliged to answer all questions.

I agree to provide information to the researchers under the conditions of confidentiality as stipulated on the information sheet.

I agree for the data I provide to be archived in the custodian of the researcher.

I understand that other researchers will have access to this data only if they agree to preserve the confidentiality of the information.

I understand that other genuine researchers may use my words in publications, reports, web pages, and other research outputs, only if they agree to preserve the confidentiality of the information as requested in this form.

I thereby agree to participate in this study under the conditions listed in the information sheet.

Signed: ……………………………………………………………………….

Name of Participant: ………………………………………………………….

Date: ………………………………………………………………………..

All correspondence should be directed to:

Adewumi Ayomikun Solomon
PhD Candidate
School of Social Sciences
University of Dundee, DD1 4HN
Scotland, UK; Email: s.a.adewumi@dundee.ac.uk

Appendix 3.5- Questionnaire A (Institutional Stakeholders)

ARCHITECTURE AND URBAN PLANNING
SCHOOL OF SOCIAL SCIENCES
UNIVERSITY OF DUNDEE

Questionnaire on "An Exploration of the Indicators of a Sustainability Assessment Framework for Neighbourhood Developments in Metropolitan Lagos"

Dear Sir/Madam

Thank you for your consent to participate in this research. This survey seeks to explore the perception of stakeholders of what a sustainable neighbourhood is and their preferences in selecting its indicators (factors). Depending on the information, I may need to come back for clarity. Thank you.

Sincerely yours,

Solomon Adewumi

Please read for clarity:

- This study is conscious of the various neighbourhood typologies that exist in metropolitan Lagos. Amidst these typologies, a neighbourhood in this research is **a medium or large scale housing development** built by either government, private developer, or through a joint venture. This is also known as a housing estate.
- The word 'neighbourhood' and 'housing estate' will be used interchangeably.
- This study aligns with the view that sustainability at the neighbourhood level can be addressed under the social, economic, environmental aspects which are interrelated.
- As earlier indicated, the focus of this research is on the neighbourhood scale. That is, how the external spaces of the building units that make up the housing estate are planned and designed.

Part A. Background Information

1. What is your year of professional experience? A. 0-5 years [ ] B. 6-10 years [ ] C. 11-20 years [ ] D. Above 20 years [ ]

2. What is the role of your agency in public housing delivery?

   ……………………………………………………………………………………….

Part B Decision-making in planning for a sustainable neighbourhood

3. Based on your professional experience, what is your definition of a sustainable neighbourhood?

   ……………………………………………………………………………………………………..

   ……………………………………………………………………………………………………

Part C Perception on sustainability indicators

6. In developing such an assessment framework that can be useful for decision-making in planning a new housing estate, this part of the questionnaire seeks your perception of what a sustainable neighbourhood is and the indicators (herein referred to as factors) that define it. The following sustainability factors have been identified under the three main aspects of sustainability as presented in the tables below. Please complete the tables below by scoring in order of importance the sustainability aspects and factors to a sustainable housing estate using a 5-point scale:

   1- Not important;

   2- Slightly important;

   3- Moderately important;

   4- Important;

   5- Very Important

Factors	Score (between 1 to 5)
Use of renewable energy	
Waste collection and management	
Strategy to maintain infrastructure	
Environmental Impact Assessment	
Pollution control	
Greenfield preservation	
Effective land usage	
Efficient use of resources	
Outdoor spaces	
Use of public arts and landscape elements	
Quality of building material	
Good pedestrian lane	
Diverse mobility option	
Nearness to basic amenities and infrastructures	
Availability of infrastructure and amenities	
Security	
Access to reliable and potable water	
Inclusive design	

Home garden to support subsistence food production	
Active frontages to encourage shops	
Use of locally made material	
Provision of a neighbourhood square	
Home affordability	
Support for Home-based business	
Cost of construction of operation, and maintenance	

b. Do you think that some sustainability factors still need to be added?

Yes [ ] No [ ]

c. If yes, can you suggest some of these factors?

Sustainability factors Score (between 1 to 5)

Appendix 3.6- Questionnaire A (Residents)

ARCHITECTURE AND URBAN PLANNING
SCHOOL OF SOCIAL SCIENCES
UNIVERSITY OF DUNDEE

Questionnaire on "An Exploration of the Indicators of a Sustainability Assessment Framework for Neighbourhood Developments in Metropolitan Lagos"

Dear Sir/Madam

Thank you for your consent to participate in this research. This survey seeks to explore your perception of what a sustainable housing estate is and your preferences in selecting its indicators. Depending on the information, I may need to come back for clarity. Thank you.

Sincerely yours,

Solomon Adewumi
(s.a.adewumi@dundee.ac.uk)

Part A **Background Information** *(for residents in public housing ONLY)*

1. Sex: A. Male [ ] B. Female [ ]

2. Marital status: A. Single [ ] B. Married [ ] C. Single parent [ ]

3. Educational status: A. No formal education [ ] B. Primary education [ ] C. Secondary education [ ] D. Higher education [ ]

4. Age: A. 18-24 [ ] B. 25-34 [ ] C. 35-54 [ ] D. 55-64 [ ] E. 65 and above

5. Occupational Status: A. Public sector [ ] B. Private sector [ ] C. Self-employed [ ] D. Unemployed [ ]

6. What is your income group? A. Below middle income [ ] B. Middle income [ ] C. Above middle income [ ] F. Not sure [ ]

8. How long have you lived in the neighbourhood? A. 1-10 years [ ]B. 10-20 years [ ] C. 20 years and above [ ]

9. What type of home do you live in? A. Semi-detached house [ ] B. Detached [ ] C. Bungalow [ ] D. Terraced house [ ] E. Flat [ ] F. Other

   If other please specify ……………………………………………

10. Under what condition do you live in the house: A. Own outright [ ] B. Owns with mortgage or loan [ ] C. Part owns and part rents (shared ownership) [ ] D. Rents [ ] E. Rent-free as member of bigger family [ ]

Part B **Your perception of your aspired neighbourhood**

2. What are the things that you cherish most in your neighbourhood that makes life comfortable for you and you will still like to have in case you move to a new housing estate?

   (i) ……………………………………………………………….

(ii) ………………………………………………………………

(iii) ………………………………………………………………

(iv)………………………………………………………………

(v) ………………………………………………………………

(vi) ………………………………………………………………

Part C Perception on sustainability factors

1. Assuming that you are to move to a new housing estate, what level of importance will you give to the three main aspects of sustainability in order to have a sustainable housing estate using the 5-point scale below?

1- Not important; 2- Slightly important; 3- Moderately important; 4- Important; 5- Very Important

Factors	Score (between 1 to 5)
Use of renewable energy	
Waste collection and management	
Strategy to maintain infrastructure	
Environmental Impact Assessment	
Pollution control	
Green field preservation	
Effective land usage	
Efficient use of resources	
Outdoor spaces	
Aesthetics (Use of public arts and landscape elements)	
Quality of building material	
Good pedestrian lane	
Diverse mobility option	
Nearness to basic amenities and infrastructures	
Availability of infrastructure and amenities	
Security	
Access to reliable and potable water	
Inclusive design	

Home garden to support subsistence food production	
Active frontages to encourage shops	
Use of locally made material	
Provision of neighbourhood square	
Home affordability	
Support for Home-based business	
Cost of construction of operation, and maintenance	

b. Do you think that some sustainability factors still need to be added?

Yes [ ] No [ ]

c. If yes, can you suggest some of these factors?

Sustainability factors Score (between 1 to 5)

Appendix 3.7- Questionnaire B

DUNDEE

ARCHITECTURE AND URBAN PLANNING
SCHOOL OF SOCIAL SCIENCES
UNIVERSITY OF DUNDEE

Questionnaire on "An Exploration of the Indicators of a Sustainability Assessment Framework for Neighbourhood Developments in Metropolitan Lagos"

Dear Sir/Madam

Thank you for your consent to participate in this research. This survey explores your perception of what a sustainable housing estate is and what indicators may be appropriate for it in order to develop an assessment framework that can be used for decision-making.

Sincerely yours,

Solomon Adewumi

Part A. Background Information

1. Which of these best describes your profession? A. Policymaker ☐ B. Planner ☐ C. Regulator ☐ D. Economist ☐ E. Architect ☐F. Engineer ☐ G. Surveyor H. Others ☐

   If other please specify

   ____

2. Your years of professional experience? A. 0-5 years ☐ B. 6-10 years ☐ C. 11-20 years ☐ D. Above 20 years ☐

3. What stage(s) of housing planning and delivery are you involved in?

   A. Briefing ☐ B. Site analysis ☐ C. Design and Design development ☐ D. Construction ☐ E. Other ☐ If other please specify

Part B. Indicators for defining a sustainable housing estate

This part of the questionnaire seeks your perception of what a sustainable housing estate is and the indicators (herein referred to as factors) that define it. Please **compare factors in column A to factors in column B** in order of their importance to a sustainable housing estate using this rating scale:

1= equal importance of both A and B;

3= moderate importance of A over B; **1/3**= moderate importance of B over A;

5= strong importance of A over B; **1/5**= strong importance of B over A;

7= very strong importance of A over B;

1/7= very strong importance of B over A;

9= extreme importance of A over B; **1/9**= extreme importance of B over A;

2, 1/2, 4, 1/4, 6, 1/6, 8, 1/8 = intermediate values

Sustainability dimensions		Rating
A	B	
Socio-cultural	Economic	
Socio-cultural	Environmental	
Economic	Environmental	

Socio-cultural factors

Sustainability factors		Rating
A	B	
Outdoor spaces	Aesthetics (Use of public arts and landscape elements)	
	Quality of building material	
	Good pedestrian lane	
	Diverse mobility option	
	Nearness to basic amenities and infrastructures	
	Availability of infrastructure and amenities	
	Security	
	Access to reliable and potable water	
	Inclusive design	
	Home garden to support food production	
	Active frontages to encourage shops	
	Use of locally made material	
	Provision of a neighbourhood square	

Sustainability factors		Rating
A	B	
Aesthetics (Use of public arts and landscape elements)	Quality of building material	
	Good pedestrian lane	
	Diverse mobility option	
	Nearness to basic amenities and infrastructures	
	Availability of infrastructure and amenities	
	Security	
	Access to reliable and potable water	
	Inclusive design	
	Home garden to support food production	
	Active frontages to encourage shops	
	Use of locally made material	
	Provision of a neighbourhood square	

Sustainability factors		Rating
A	B	
Quality of building material	Good pedestrian lane	
	Diverse mobility option	
	Nearness to basic amenities and infrastructures	
	Availability of infrastructure and amenities	
	Security	
	Access to reliable and potable water	
	Inclusive design	
	Home garden to support food production	
	Active frontages to encourage shops	
	Use of locally made material	
	Provision of a neighbourhood square	

Sustainability factors		Rating
A	B	
Good pedestrian lane	Diverse mobility option	
	Nearness to basic amenities and infrastructures	
	Availability of infrastructure and amenities	
	Security	
	Access to reliable and potable water	
	Inclusive design	
	Home garden to support food production	
	Active frontages to encourage shops	

	Use of locally made material	
	Provision of a neighbourhood square	

Sustainability factors		Rating
A	B	
Diverse mobility option	Nearness to basic amenities and infrastructures	
	Availability of infrastructure and amenities	
	Security	
	Access to reliable and potable water	
	Inclusive design	
	Home garden to support food production	
	Active frontages to encourage shops	
	Use of locally made material	
	Provision of a neighbourhood square	

Sustainability factors		Rating
A	B	
Nearness to basic amenities and infrastructures	Availability of infrastructure and amenities	
	Security	
	Access to reliable and potable water	
	Inclusive design	
	Home garden to support food production	
	Active frontages to encourage shops	
	Use of locally made material	
	Provision of a neighbourhood square	

Sustainability factors		Rating
A	B	
Availability of infrastructure and amenities	Security	
	Access to reliable and potable water	
	Inclusive design	
	Home garden to support food production	
	Active frontages to encourage shops	
	Use of locally made material	
	Provision of a neighbourhood square	

Sustainability factors		Rating
A	B	
Security	Access to reliable and potable water	
	Inclusive design	
	Home garden to support food production	
	Active frontages to encourage shops	
	Use of locally made material	
	Provision of a neighbourhood square	

Sustainability factors		Rating
A	B	
Access to reliable and potable water	Inclusive design	
	Home garden to support food production	
	Active frontages to encourage shops	
	Use of locally made material	
	Provision of a neighbourhood square	

Sustainability factors		Rating
A	B	
Inclusive design	Home garden to support food production	
	Active frontages to encourage shops	
	Use of locally made material	
	Provision of a neighbourhood square	

Sustainability factors		Rating
A	B	
Home garden to support food production	Active frontages to encourage shops	
	Use of locally made material	
	Provision of a neighbourhood square	

Sustainability factors		Rating
A	B	
Active frontages to encourage shops	Use of locally made material	
	Provision of a neighbourhood square	

Sustainability factors		Rating
A	B	
Use of locally made material	Provision of a neighbourhood square	

Environmental factors

Sustainability factors		Rating
A	B	
Quality of building material	Use of renewable energy	
	Waste collection and management	
	Strategy to maintain infrastructure	
	Environmental Impact Assessment	
	Pollution control	
	Greenfield preservation	
	Effective land usage	
	Efficient use of resources	

Sustainability factors		Rating
A	B	
Use of renewable energy	Waste collection and management	
	Strategy to maintain infrastructure	
	Environmental Impact Assessment	
	Pollution control	
	Greenfield preservation	
	Effective land usage	
	Efficient use of resources	

Sustainability factors		Rating
A	B	
Waste collection and management	Strategy to maintain infrastructure	
	Environmental Impact Assessment	
	Pollution control	
	Greenfield preservation	
	Effective land usage	
	Efficient use of resources	
Sustainability factors		Rating
A	B	

Strategy to maintain infrastructure	Environmental Impact Assessment	
	Pollution control	
	Greenfield preservation	
	Effective land usage	
	Efficient use of resources	

Sustainability factors		Rating
A	B	
Environmental Impact Assessment	Pollution control	
	Greenfield preservation	
	Effective land usage	
	Efficient use of resources	

Sustainability factors		Rating
A	B	
Pollution control	Green field preservation	
	Effective land usage	
	Efficient use of resources	

Sustainability factors		Rating
A	B	
Green field preservation	Effective land usage	
	Efficient use of resources	

Sustainability factors		Rating
	B	
Effective land usage	Efficient use of resources	

Economic factors

Sustainability factors		Rating
A	B	
Home affordability	Support for Home-based business	
	Cost of construction of operation, and maintenance	

Sustainability factors		Rating
A	B	
Support for Home-based business	Cost of construction of operation, and maintenance	

Appendix 3.8- Questionnaire C

Questionnaire on "An Exploration of the Indicators of a Sustainability Assessment Framework for Neighbourhood Developments in Metropolitan Lagos"

Dear Sir/Madam

Thank you for your consent to participate in the second phase of this study. The information that you provided in the first phase was helpful in identifying and ranking the sustainability indicators of an assessment framework (from the most important to the least important)that could be used to assess a proposed neighbourhood (housing estate) in metropolitan Lagos. The aim of this phase is to **test the applicability and usability of the indicators** as regards their uptake and consideration in planning a new neighbourhood in metropolitan Lagos.

Please refer to Table 1 to respond to sections B and C.

Please kindly also note that any information you provide is mainly for this study and your confidentiality is guaranteed. All your data protection rights will be observed.

Sincerely yours,
Solomon Adewumi (s.a.adewumi@dundee.ac.uk)

SECTION A: BACKGROUND INFORMATION

1. **What is your role in neighbourhood planning?**
   a. Developer (i) private (ii) government b. Regulator c. Any other
   Please specify ....

2. **Year of professional experience**

a. 0-5 b. 6- 10 c. 11-20 d. Above 20 years

3. **Number of neighbourhoods/ housing estates development you have been involved in the last 20 years**

   a. 0-5 b. 6- 10 c. 11-20 d. Above 20

SECTION B: INDICATOR SET

4. **To what extent do you agree with the indicator set in terms of its comprehensiveness in addressing sustainability at the neighbourhood level in metropolitan Lagos?**
   a. Strongly disagree b. Disagree c. Neutral d. Agree e. Strongly agree
5. **To what extent do you agree with the ranking of the indicators from the most important to the least important?**
   a. Strongly disagree b. Disagree c. Neutral d. Agree e. Strongly agree

SECTION C: USABILITY

6a. Do you think that the indicator set is easy to apply in planning a new neighbourhood? a. Yes b. No
6b. Do you agree that your ministry/agency can adopt the indicators in the decision-making process of a new neighbourhood?
   a. Strongly disagree b. Disagree c. Neutral d. Agree e. Strongly agree
Please give comments...

7. **To what extent are the following barriers critical for the uptake of the indicators in the context of metropolitan Lagos (1- not critical; 2- less critical; 3- neutral; 4- critical; 5- very critical)**

Barriers	Level of criticality				
	1-not critical	2- Less critical	3- neutral	4- critical	5- very critical
1. High cost of implementation					
2. Unavailability of data to implement the indicators					
3. Technological know-how and expertise to apply them					
4. Non-Incentives for sustainable innovations					
5. Inadequate awareness of sustainability & its benefits					
6. Lack of financing schemes for developers					
7. Desire by developers to maximise profit					
8. Resistance to change					
9. Inadequate research on sustainability indicators					
10. Lack of demonstration (sample) projects					
11. Lack of interest from professionals & market demand					
12. Corrupt practices					
13. Weak enforcement of policies					
Please identify any other barriers not listed, and indicate their level of criticality					

8. Which solutions would you recommend to the most critical of the barriers?

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9. How do you think that the indicators can fit into the existing framework for physical planning in metropolitan Lagos? (e.g. at the planning stage; design stage; and approval stages etc)

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10. Could such sustainable neighbourhood be profitable or enjoy market share in Lagos?

a. Yes and now **b.** Yes but not now **c.** Yes and no **d.** no but may be in the future **e.** not in the foreseeable future. Please explain

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Table 1- Indicator set, assessment criteria, and ranking

Indicators	Assessment criteria	Index value (Rank)
Cost of construction, operation, and maintenance	An estimated breakdown of the total cost of construction; operation; and maintenance of the neighbourhood including the infrastructure and amenities of the proposed neighbourhood	12.3 (1st)
Home affordability	-Integrated distribution of various dwelling types to accommodate diverse income groups and users -Friendly tenure housing systems e.g. rent, mortgage, or outright purchase	10.1(2nd)
Support for a home-based business	-Integration of both residential and commercial developments to encourage working from home -Economy study of how the proposed neighbourhood will contribute to surrounding economy	8.7 (3rd)
Environmental Impact Assessment	A detailed EIA report that demonstrates the integration of sustainability aspects	6.4 (4th)
Efficient use of resources	Water efficiency: Estimate of overall water consumption target for construction and daily use in household Actions to minimise or not exceed water consumption target e.g. landscape design options, water metering, and rainwater collection among others Energy efficiency: An energy strategy plan showing: -estimate of total energy demand of the neighbourhood -design measures to reduce energy demand e.g. site layout and orientation, shading devices and solar orientation, daylighting and natural ventilation -possibility of importing or exporting energy to existing or new neighbourhoods	6.0 (5th)
Pollution control	Noise pollution: -the sources of noise to the site and how they can be addressed -design decisions to minimise noise e.g. use of landscape elements; acoustic in congregational buildings -policies to reduce noise from congregational buildings, and music vendors -a commitment to achieve reasonable noise level through road layout, building orientation and creation of buffer zones Water pollution: -a detailed drainage plan for the proposed neighbourhood -measures to avoid pollution of existing watercourse during construction and operation of the neighbourhood (e.g. treatment of run-offs from hard surfaces; and water pollutants) Air pollution: Strategy to ensure minimal air pollution during construction and operation of the neighbourhood	5.1 (6th)

Waste collection and management	Waste management strategy showing among others: (i) estimate of amount of excavation waste (soil and stones) that would be generated and how the waste will be maximally reused during construction (ii) estimate of other construction waste to be recycled (iii) strategy for household waste collection e.g. method and frequency (iv) strategy for household waste management e.g. estimate of household wastes to be recycled	4.9 (7th)
Strategy to maintain infrastructure	A detailed management plan for infrastructure such as road, drainage, waste treatment plan, and also for amenities like schools, health centres, and other public buildings	4.4 (8th)
Effective land usage	-A detailed site plan showing how the site has been maximised and percentage of land for circulation -Design strategies to ensure effective land usage e.g. densification	4.0 (9th)
Use of renewable energy	Consideration for possible use of renewable sources for power generation e.g. solar or wind	3.7 (10th)
Green field preservation	-Possibility of re-use of existing land to preserve greenfield areas -Site plan of proposed neighbourhood showing land use analysis in terms of buildable areas and green areas preserved	3.4 (11th)
Access to potable water	- Each dwelling connected to a water source -Water treatment plan for proposed neighbourhood	3.6 (12th)
Availability of infrastructure and amenities	- Evidence of survey of existing amenities and facilities neighbourhoods - Site plan of neighbourhood showing amenities based on survey -Infrastructural plan of the proposed neighbourhood -a detailed spatial analysis of the amenities to be provided showing capacity	3.5 (13th)
Quality of construction material	-a specification note showing the quality of material to be used for construction to ensure that it meets the required standard	3.4 (14th)
Security	-an evidence of how the security of the neighbourhood is considered and addressed through design - Security plan and strategies for the neighbourhood when in operation including emergency responses	3.1(15th)
Nearness to basic amenities	-A considerate travel time to access neighbourhood amenities - Site plan showing that amenities are within walking distance from dwelling units through safe pedestrian routes.	2.9 (16th)
Use of locally made material	-Percentage of construction material that will be sourced locally	2.5 (17th)
Outdoor spaces	-Site plan of neighbourhood showing spaces for outdoor activities located closed to each dwelling, block or streets	2.2(18th)
Diverse mobility option	-A mobility plan showing the layout and design of streets which promotes sustainable modes of transportation such walking and cycling -A transit-oriented development - Connection to existing road and routes in the neighbourhood area	2.2 (18th)

Inclusive design	- Evidence of consultation with necessary stakeholders (e.g. local authority; residents or community representative of existing neighbourhood) in the design of the neighbourhood -Design consideration for the aged, young, and physically-challenged	2.0 (20th)
Use of public arts and landscape elements (Aesthetics)	- Neighbourhood design and elements such as colour, architectural style, building form to reflect the local context - Continuity of neighbourhood with existing development - Use of landscape elements for beautification	1.9 (21st)
Good pedestrian lane	- Neighbourhood design and elements such as colour, architectural style, building form to reflect the local context - Continuity of neighbourhood with existing development - Use of landscape elements for beautification	1.9 (21st)
Neighbourhood squares	Site plan of proposed neighbourhood showing a centrally located neighbourhood square	1.8 (23rd)

Appendix 4- Publications to Date from the Study

Journal Article

1. Adewumi, A, S; Onyango, V; Moyo, D; and AlWaer, H (2019). *A review of selected neighbourhood sustainability assessment frameworks using the Bellagio STAMP*. International Journal of Building Pathology and Adaptation, Vol. 37 Issue: 1, pp. 108-118, https://doi.org/10.1108/IJBPA-07-2018-0055

Edited and Peer reviewed Conference Proceedings

2. Adewumi, A, S; AlWaer, H; and Onyango, V (2018). *Operationalising the Bellagio Stamp using Selected Neighbourhood Sustainability Assessment Frameworks.* RICS COBRA Conference. London 23-24 April, 2018. Accessible at https://www.rics.org/globalassets/rics-website/media/knowledge/research/conference-papers/operationalising-the-bellagio-stamp-using-selected-neighbourhood-sustainability-assessment-frameworks-rics.pdf

3. Adewumi, A, S; AlWaer, H; and Onyango, V (2017). *Conceptualising Sustainable Neighbourhoods through Collaborative Placemaking*. World Sustainable Built Environment Conference on: “Transforming our Built Environment though Innovation and Integration: Putting Ideas into Action”. Construction Industry Council, Hong Kong Green Building Council Limited. Hong Kong 5-7 June, 2017. Pp. 2555-2560.

4. Adewumi, A, S (2016). *Problematising a conceptual assessment framework for sustainability at the neighbourhood level in Sub-Saharan Africa*: *A case study of Nigeria* presented at the CHOBE/ARCOM Doctoral Workshop-Going North for Sustainability held at London South Bank University (LSBU), London, UK on 30/06/2016. Accessible at http://www.arcom.ac.uk/-docs/workshops/2016-06-CHOBE-Proceedings.pdf